

# FRESHWATER CRAYFISH OF THE GENUS *EUASTACUS* CLARK (DECAPODA: PARASTACIDAE) FROM QUEENSLAND

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## Abstract

Morgan, G.J., 1988. Freshwater crayfish of the genus *Euastacus* Clark (Decapoda: Parastacidae) from Queensland. *Memoirs of the Museum of Victoria* 49: 1-49.

Twelve species of *Euastacus* from Queensland, including three new species, *E. balanensis*, *E. eungella* and *E. jagara*, are described or redescribed, employing external characters, measurement ratios and gastric mill characters. The genus *Euastacoides* Riek is synonymised with *Euastacus*. A key to the Queensland species of *Euastacus* is included.

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## Introduction

The species of the Australian freshwater crayfish genus *Euastacus* occurring in Victoria have been reviewed by Morgan (1986) in the first of a series of papers. This second contribution examines species found exclusively in Queensland or with type localities in that state.

The methods and abbreviations employed in this study are those described by Morgan (1986). Additionally, the Queensland Museum, Brisbane, is abbreviated as QM. Scales in figures 3-25 are in mm.

The eastern area of Queensland was sampled extensively for this study in 1981, with particular emphasis upon high country of the Great Dividing Range. Distributions of species are illustrated in Figures 1 and 2.

## *Euastacus balanensis* sp. nov.

Figures 3, 4

*Material examined.* Holotype. Qld, tributary of Davies Ck, Lamb Range, Atherton Tableland, (17°03'S, 145°37'E), 2 Jul 1981, G.J. Morgan and S.J. Harders, QM W10984, ♂, OCL 33.0 mm.

Paratypes. Qld. Type locality, QM W10985, 1 ♀; Tributary of Kauri Ck, north of Tinaroo Falls Dam, Atherton Tableland, (17°06'S, 145°35'E), 1 Jul 1981, G.J. Morgan and S.J. Harders, QM W10987, 2 ♂; Maguba Ck, Mt Bartle Frere, Bellenden Ker Range (17°26'S, 145°50'E), 18 Jul 1981, G.J. Morgan and S.J. Harders, QM W10986, 1 ♂, 1 ♀.

*Diagnosis.* Male cuticle partition present. Rostral marginal spines apical or distributed to midlength of carinae. Rostral base very divergent, carinae spread. Antennal squame widest at or slightly proximal to midlength. Squamal spines absent. Suborbital spine usually medium-sized. Thoracic spines weakly developed. General tubercles small, moderately to densely distributed. 3-8 medium-sized or small Li spines on abdominal somite 2. D abdominal spines and abdominal boss absent. Tailfan spines absent. Lateral propodal spines usually in 2 to 1 row condition, ventral row poorly developed (occasionally absent). 0-2 dorsal apical propodal

**Key to Queensland species of *Euastacus* (specimens >20 mm OCL)**

1. Carpus of cheliped with deep longitudinal groove in dorsal surface; at least 1, usually several, mesal dactylar spines ..... 2
- Carpus of cheliped with very shallow longitudinal groove in dorsal surface; mesal dactylar spines absent ..... 11
- 2(1). Thoracic and telsonic spines medium-sized to large, or if thoracic or telsonic spines small or absent: lateral propodal spines in 2 to 1 row condition, rostral carinae of medium length to long, suborbital spine large to very large; usually 2 mesal carpal spines, or if 3: usually large thoracic or D-L abdominal spines. [Species can grow very large, with large and sharp Li and D-L abdominal spines] ..... 3
- Thoracic spines absent or just discernible (rarely few small dorsal spines behind cervical groove) and above character combination not applicable; 3 or more mesal carpal spines. [Small species with poor abdominal spination] ..... 6
- 3(2). Mesal dactylar basal spines absent ..... *E. valentulus*
- 1 or more dorsal mesal dactylar basal spines and sometimes marginal mesal basal spines ..... 4
- 4(3). Dorsal thoracic spines absent (sometimes just discernible); telsonic spines small or absent; usually 2-10 dorsal apical propodal spines; TAP  $\leq 5$  ..... *E. sulcatus*
- Dorsal thoracic spines medium-sized or large; telsonic spines usually medium-sized or large (sometimes small); usually 0 or 1 dorsal apical propodal spine, or if more than 1: telsonic spines large; TAP  $\geq 5$  ..... 5
- 5(4). Telsonic spines small or medium-sized; D abdominal spine present and usually sharp on somites 2-4; red spines on abdomen and thorax; 0 (rarely 1) lateral spine on outer ramus of uropod ..... *E. suttoni*
- Telsonic spines usually large; D abdominal spine absent on somites 2-4 (dorsal boss present) or rarely very blunt D spine; overall colour dark green, including spines; 3-6 lateral spines on outer ramus of uropod [Usually 2 distinct spines per side on epistome] ..... *E. hystriacus*
- 6(2). Row of spines above propodal and dactylar cutting edges reaching proximal to midlength of chela gape or to full gape; ventrolateral propodal spine row well developed ..... *E. eungella*
- Spines above propodal and dactylar cutting edges absent or not distributed proximal to midlength of chela gape; ventrolateral propodal spine row absent or poorly developed (usually fewer than 4 spines if present) .... 7
- 7(6). Li abdominal spines small or medium-sized on somite 2, or if merely bumps; keel Pr3 parallel and 1 apical mesal dactylar spine ..... 8
- Li abdominal spines reduced to low bumps and above combination of characters not applicable ..... 10
- 8(7). Dorsal apical propodal spines absent; antennal squame widest very proximal to midlength; keel Pr3 parallel ..... *E. urospinosus*
- 1-2 dorsal apical propodal spines, or if absent: antennal squame widest at midlength or only slightly proximal to midlength; keel Pr3 not parallel 9
- 9(8). Rostral spines distributed along full length of carinae; keel Pr1 close; suborbital spine small ..... *E. maidae*
- Rostral spines apical or distributed to midlength of carinae (rarely slightly proximal to midlength); keel Pr1 apart or very apart; suborbital spine medium-sized or medium-large ..... *E. balanensis*

- 10(7). Suborbital spine medium-large to very large; 2 apical mesal dactylar spines; antennal squame widest very proximal to midlength ..... *E. setosus*  
 — Suborbital spine small or very small; 1 apical mesal dactylar spine; antennal squame widest slightly proximal to midlength ..... *E. jagara*
- 11(1). Ventrolateral propodal spine row poorly developed and central; usually 4-5 mesal propodal spines; keel Pr 3 and 4 usually narrow; TAP count 8.0-9.5. [Rostrum U-shaped on large specimens] ..... *E. fleckeri*  
 — Ventrolateral propodal spine row reaching to apex; 6-9 mesal propodal spines; keel Pr3 and 4 broad or very broad; TAP count 4.5-5.0 (Rostrum usually triangular) ..... *E. robertsi*

spines. Spines absent above propodal cutting edge. 5 mesal propodal spines. 1 apical spine above dactylar cutting edge. Dorsal and marginal mesal dactylar basal spines absent. 1 apical mesal dactylar spine. Carpal dorsolongitudinal groove deep. 3-4 mesal carpal spines. Largest ventromesal carpal spine usually subequal in size to ventral spine. Keel Pr1 sloped to semi-abrupt and apart or very apart. TAP count 3.5.

**Description** Maximum OCL: 33.0 mm.

**Rostrum:** Short, not or just reaching base of antennal segment 3 on specimens >30 OCL, to or slightly distal to base of segment on specimens 20-30 OCL. Rostral sides parallel, rarely slightly convergent; base very divergent and spread. Rostral marginal spines numbering 2-3 per side, and either apical or reaching midlength of carinae; spines medium-sized to small or moderately pointed or rounded. Acumen spine similar to marginals.

OCL/CL 0.85-0.88 i. RW/OCL 0.14-0.17 d.

**Cephalon:** Spination moderate or weak with several small spines below postorbital ridges. 1st postorbital spine small, 2nd postorbital spine absent. Suborbital spine usually medium-sized, large on some specimens >30 OCL. Lateral margin of squame straight or slightly concave; squame widest at or slightly proximal to midlength; marginal spines absent. Interantennal spine elongate with margins smooth to serrated, and slightly toothed on one specimen; ventromedial surface sometimes bearing small spine. Antennal basipodite spine small or absent; coxopodite spine small or absent, sometimes weakly bifid or serrated.

ScL/OCL 0.14-0.17 d.

**Thorax:** Dorsal thoracic spines very weakly developed; specimens >30 OCL usually with 1-2 small, blunt spines behind cervical spines. General tubercles small, moderately to densely distributed. Cervical spines numbering 3-6, medium-sized to small (usually similarly sized) and moderately pointed to blunt.

ArL/OCL 0.38-0.40. CaW/OCL 0.53-0.56. ArW/OCL 0.16-0.20 d. CaD/OCL 0.43-0.47 d.

**Abdomen:** Somite 1 lacking spines. Somite 2 of specimens >30 OCL with 3-8 Li spines per side, frequently 1 or 2 obviously larger than other usually tiny, rather blunt spines. Anterior Li spines small to medium-sized and moderate to sharp. Tiny Li spine on somites 3-5. Of two specimens <30 OCL, one with 3 small Li spines on so-

mite 2, other lacking spines; subsequent somites lacking spines. 1 or 2 tiny, blunt Lii spines sometimes on somites 3-5 of large crayfish. Somite 6 sometimes with 1-3 tiny Lii spines. D-L and D spines and dorsal boss absent.

AbdW/OCL  $\sigma$  0.45-0.51,  $\varphi$  0.52-0.54. OCL/L 0.41-0.43 i.

**Tailfan:** Tailfan spines absent though setal bumps obvious on margins of telson and uropods. Standard spines small, medium-sized on one specimen <30 OCL.

TeL/OCL  $\sigma$  0.31-0.37 d,  $\varphi$  0.34-0.35.

**Chelae:** Chelae elongate on specimens >30 OCL, intermediate in shape on smaller crayfish. Lateral propodal edge often concave. Teeth moderately to well developed on specimens >30 OCL.

**Propodus:** Lateral propodal spines usually in 2 to 1 row condition, ventral row poorly developed, often merely 2-3 midlateral spines; one large specimen lacking ventral row. Lateral spines small to medium-sized and rather sharp. Lateral spine ridge absent. 5 mesal propodal spines (one specimen with 6 on apparently regenerate chelae). 0-2 dorsal apical propodal spines. No spines above cutting edge of propodus (one specimen with 2 small apical spines on regenerate chelae). Dorsal spines lateral to dactylar base usually absent (one specimen with small spine on its smaller chela); very slight lateral bumps present. Ventrally, 1-2 small spines lateral to dactylar base. No spines proximal to dactylar articulation. 0-2 small precarpal spines.

PropL/OCL 0.87-0.98 i. PropW/PropL 0.43-0.47. PropD/PropL 0.27-0.31.

**Dactylus:** 1 spine above cutting edge of dactylus (one specimen <30 OCL lacking spine; one specimen with 3 spines on regenerate chelae); spine apical and large to small. Extra dorsal dactylar spines absent. Basal mesal dactylar spines absent. 1 apical mesal dactylar spine. Dactylar groove deep.

DactL/PropL 0.57-0.59.

**Carpus:** Dorsolongitudinal groove deep. 3-4 mesal carpal spines; distalmost largest and offset ventrally to others. Usually 2 (occasionally 1) medium-sized to tiny lateral spines. Articulation spine small or absent. Dorsal carpal spines absent. Ventral spine medium/large or medium-sized; 3-5 ventromesal spines, largest usually subequal in size to ventral spine.

**Merus:** 5-10 small dorsal meral spines. Outer spine small.

**Keel:** Pr1: Posterior margin sloped to semi-abrupt; ventral edge usually angled back (angled down on one speci-

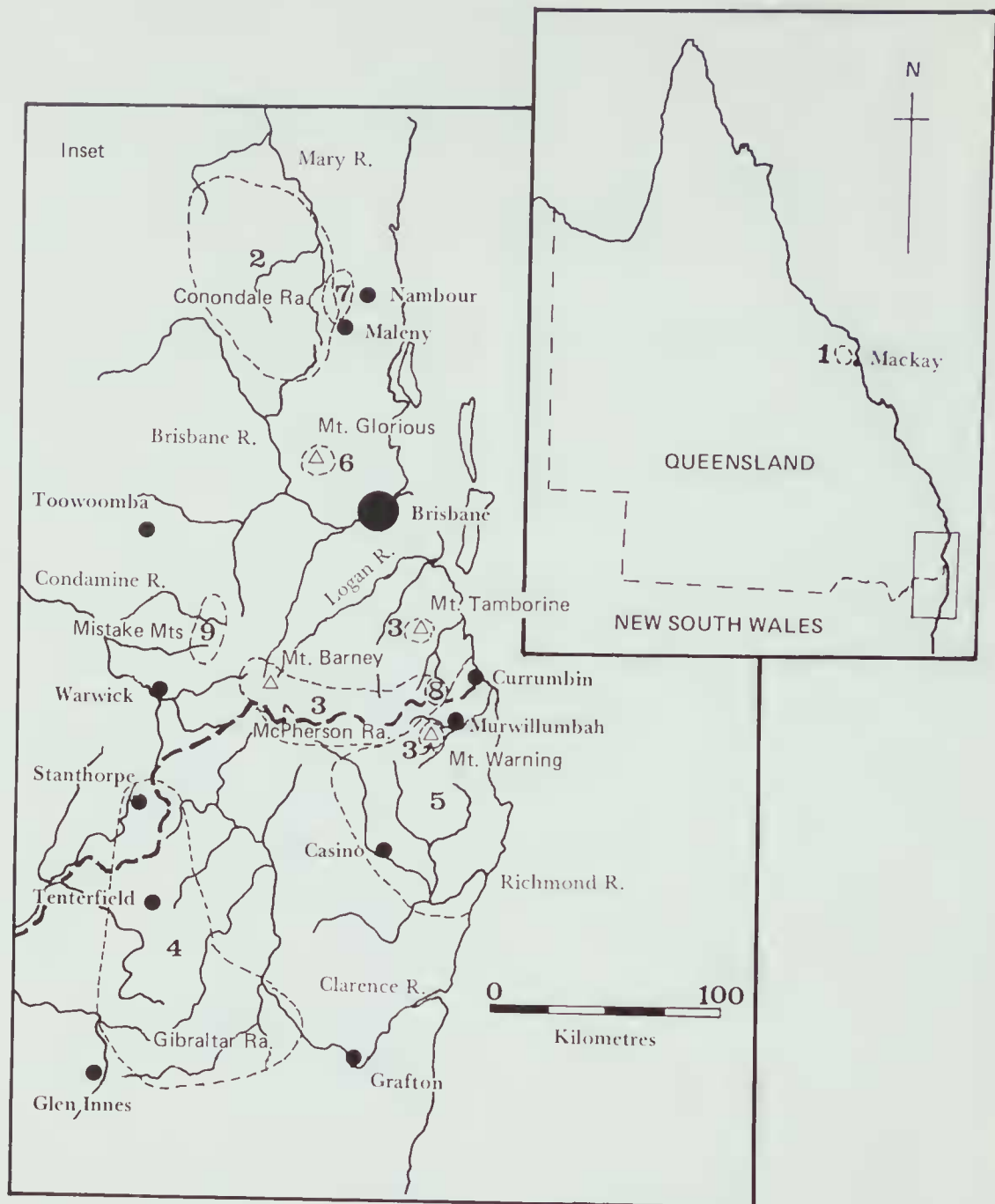


Figure 1. Distribution of *Euastacus* species in Queensland—1, *E. eungella*; 2, *E. hystricosus*; 3, *E. sulcatus*; 4, *E. suttoni*; 5, *E. valentulus*; 6, *E. setosus*; 7, *E. urospinosus*; 8, *E. maidae*; 9, *E. jagara*.



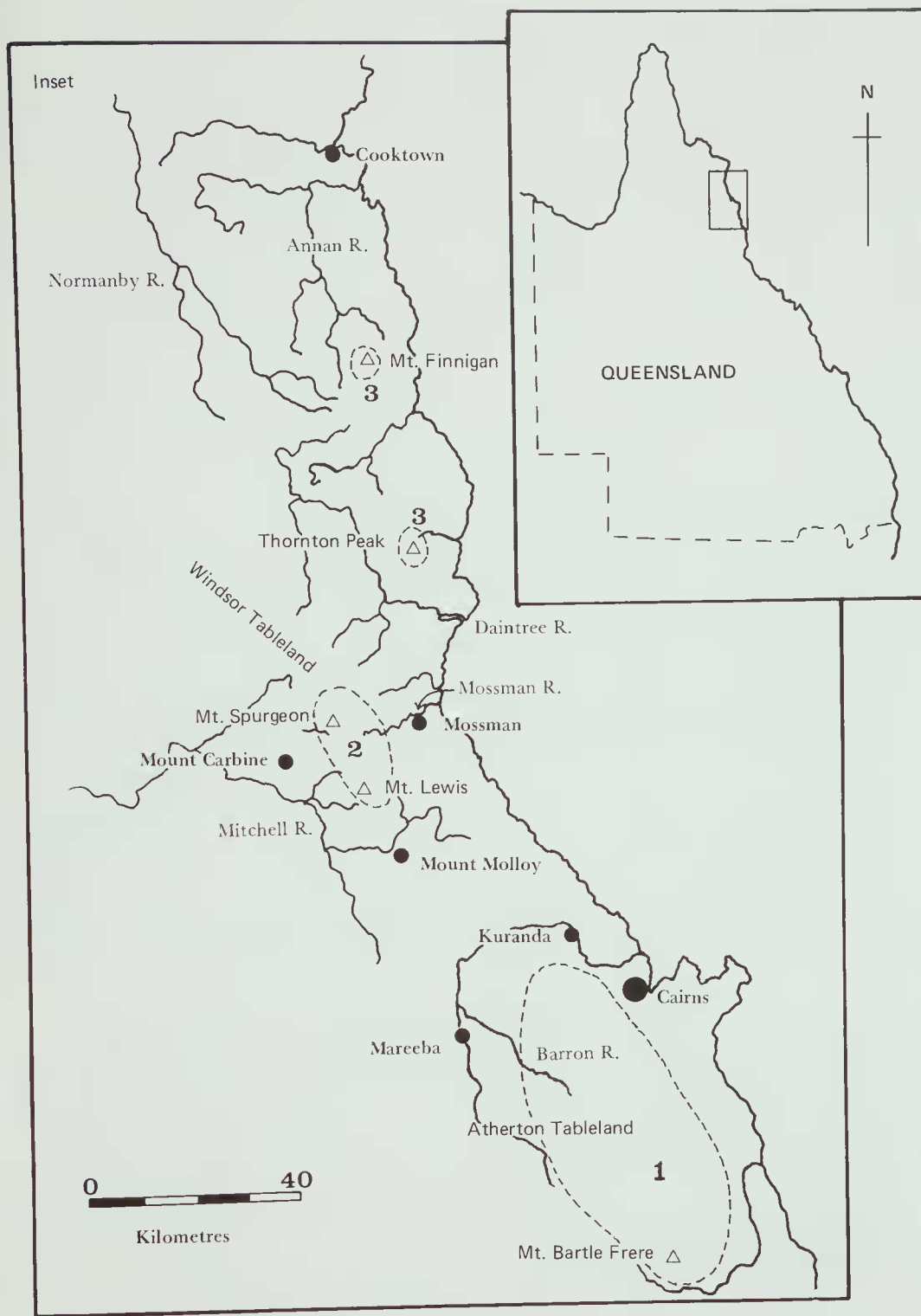


Figure 2. Distribution of *Euastacus* species in Queensland—1, *E. balanensis*; 2, *E. fleckeri*; 3, *E. robertsi*.

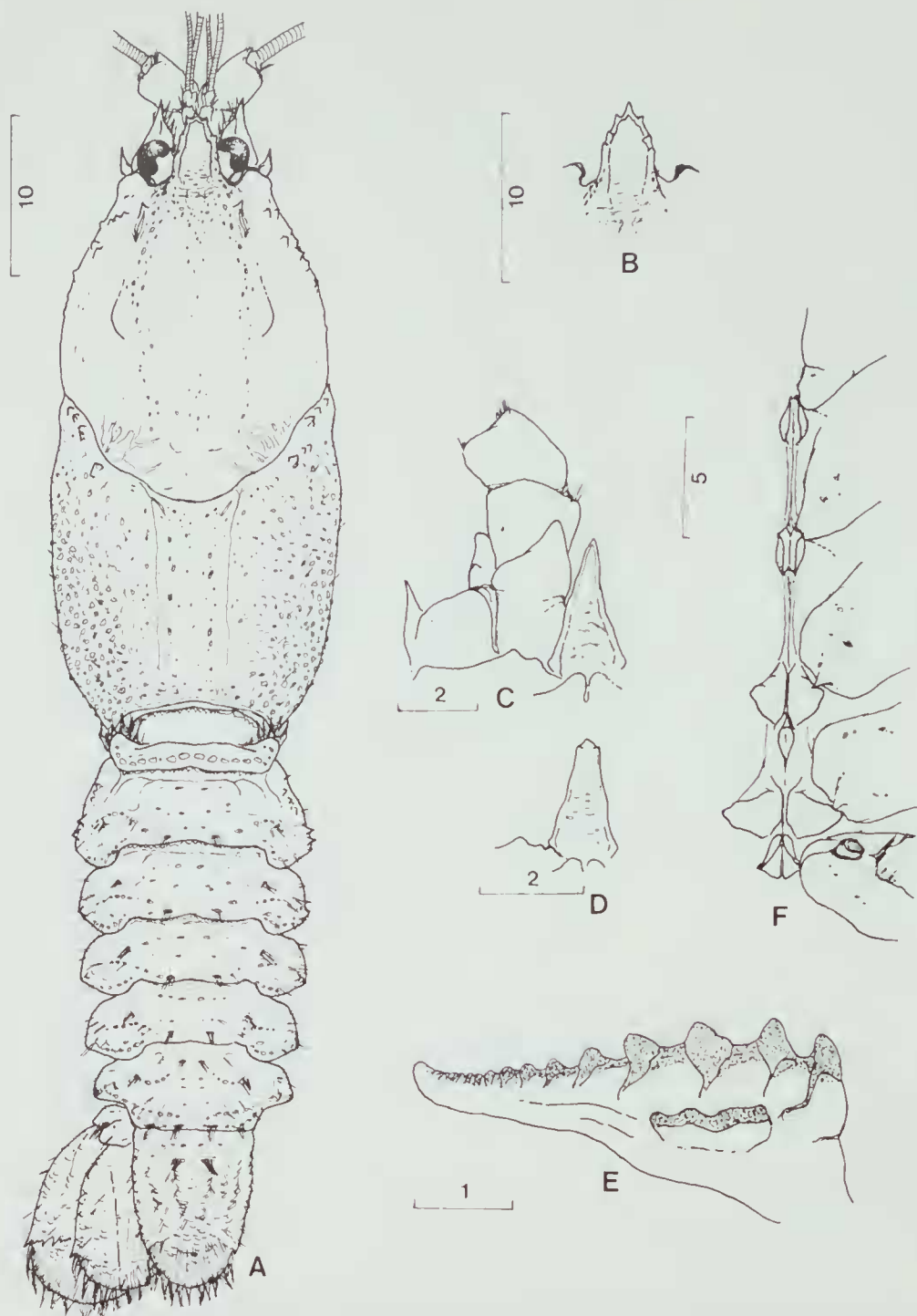


Figure 3. *Euastacus balanensis*. A, dorsal view (holotype ♂, Davies Ck, QM W10984); B, rostrum: broader, more spinose (paratype ♂, Kauri Ck, QM W10987); C, ventral view cephalon (holotype ♂); D, interantennal spine (paratype ♂, Kauri Ck); E, zygocardiac ossicle (paratype ♀, Maguba Ck, QM W10986); F, sternal keel (holotype ♂).

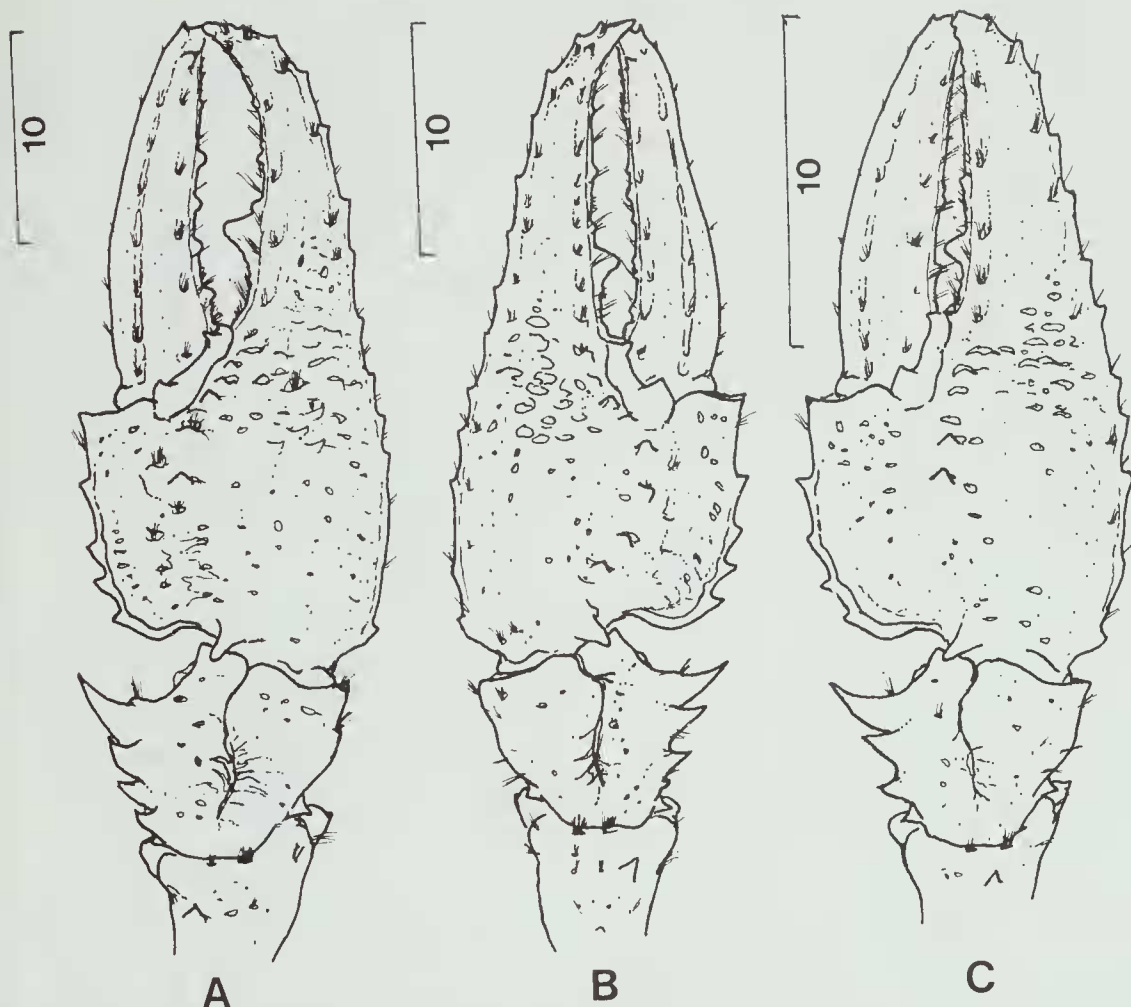


Figure 4. *Euastacus balanensis*. A, dorsal view chela (holotype ♂); B, chela: more elongate, 2 apical dorsal propodal spines, 4th mesal carpal spine small (paratype ♀, Davies Ck, QM W10985); C, chela: stouter, 3 mesal carpal spines (paratype ♂, Maguba Ck, QM W10986).

men); processes apart or very apart and closed in orientation. Keel after Pr1 sometimes with low spine.

Pr2: Open or parallel, and very apart. Keel after Pr2 slightly pronounced anteriorly.

Pr3: Lateral profile moderately rounded or sharp, lacking or with very gradual scoops. Keel after Pr3 pronounced anteriorly.

Pr4: Posterior edge moderate to sharp and straight, slightly convex or irregular. Scoops absent. Anterior margins angular or very angular.

Processes 3 and 4 broad with sharp narrow keel.

**Setation:** Moderate to rather heavy. Bartle Frere crayfish more setose than those from Atherton Tableland.

**Punctuation:** Moderate to dense on cephalon, dense or very dense on thorax.

**Gastric mill:** TAP count 3.5; TAA count 1.0-1.5; spread 2.0-2.5. Teeth large and spaced.

Urocardiac ridges 4-5 (rarely 6).

**Coloration:** Body dark green/brown or olive dorsally, paler brown ventrolaterally. Dorsal spines (if present) and cephalic spines pale orange. Rostral carinae dark green. Abdominal L spines brown or pale green. Carpus and propodus of cheliped green/brown, spines tipped with orange. Fingertips paler.

Body ventrally orange and green. Chelae green/orange, often blue patch at carpal/propodal articulation. Propodal and dactylar mesal edges dark green. Fingers orange, tips often yellow.

Very small specimens orange, pink or grey.

**Sexes:** Males possess a wide cuticle partition.

Two females were collected, both in the 30-40 OCL range. On one, the gonopores appear to be opening. The other is berried with open gonopores. Hence, females probably mature at lengths close to 30 OCL. Eggs are orange/brown.

**Distribution and biology.** The species has been collected in tropical rainforests at altitudes above 800 m a.s.l. on the Atherton Tableland, west of Cairns and from the Bellenden Ker Range west of Babinda. This is the highest country in Queensland. At lower altitudes, species of *Cherax*, *Macrobrachium* and *Atyoida* were common. No specimens of *Euastacus* were collected adjacent to human habitation. The berried female was obtained from a shallow burrow in July.

**Etymology.** Name derived from "balan" (fresh water) in Dyirbal, the major language of the Bellenden Ker area (Dixon, 1972).

**Remarks.** Only six specimens of this small species have been collected from a relatively small area of north Queensland and geographical variation cannot be interpreted.

#### *Euastacus eungella* sp. nov.

Figures 5, 6

**Material examined.** Holotype. Qld, tributary of Cattle Ck (North Branch), near Mt Dalrymple, Eungella National Park, west of Mackay, (21°02'S, 148°37'E), 13 Jun 1981, G.J. Morgan and S.J. Harders, QM W10980, ♂, OCL 33.0 mm.

Paratypes: Qld. Type locality, QM W10981, 1♂, 4♀; Creek 1 km along track from Crediton Camp, Eungella Nat. Park, (21°11'S, 148°31'E), 11 Jun 1981, G.J. Morgan and S.J. Harders, QM W10982, 3 juveniles; Cattle Ck (South Branch), Eungella Nat. Park, (21°08'S, 148°30'E), 12 Jun 1981, G.J. Morgan and S.J. Harders, QM W10983, 1♀; Clarke Range near Crediton, 17 Apr 1975, QM W4806, 3♂, 3♀, 1 chela.

**Diagnosis.** Similar to *E. balanensis*, except: rostral marginal spines not apical, distributed to, or proximal to midlength of carinae. Antennal squame widest at or slightly distal to midlength. 4-9 Li spines on abdominal somite 2. 2 lateral propodal spine rows, ventral row well developed. Usually 2-4 dorsal apical propodal spines. Spines above propodal and dactylar cutting edges distributed proximal to midlength of gape. 5-6 mesal propodal spines. 0-2 dorsal mesal dactylar basal spines. 1-3 apical mesal dactylar spines. Proximalmost (4th) mesal carpal spine absent or small. Ventromesal carpal spine smaller than ventral spine. Keel Pr1 close. TAP count 3.5-4.0.

**Description.** Maximum OCL: 33.0 mm.

**Rostrum:** Short, usually not reaching beyond base of

3rd antennal segment, occasionally slightly beyond on specimens <20 OCL. Rostral sides parallel or slightly convergent; carinal base short, spread and divergent or very divergent. 3-5 marginal spines per side, small or medium-sized and moderately pointed; spines distributed to midlength or proximal to midlength of carinae. Acumen spine similar to or slightly larger than marginal spines.

OCL/CL 0.81-0.86 i. RW/OCL 0.16-0.20.

**Cephalon:** Spination moderate or weak, with 1-3 small spines and bumps below postorbital ridges. First postorbital spine medium-sized or small. 2nd postorbital spine absent (one specimen <20 OCL with very small spine on one side only). Suborbital spine usually medium-sized, large on some specimens <30 OCL. Lateral margin of squame usually slightly concave; squame widest at or slightly distal to midlength; marginal spines absent. Interantennal spine elongate or of medium width on specimens >20 OCL, broad on some smaller animals; spine margins slightly or distinctly scalloped, ventromedial surface often with small blunt spine. Antennal basipodite spine small or absent; copopodite spine very small and weakly bifid, or absent.

ScL/OCL 0.14-0.23 d.

**Thorax:** Dorsal spines very poorly developed or absent, just discernible on some large specimens, sometimes 1-2 small blunt spines posterior to cervical spines. General tubercles small to very small, dense or moderately dispersed on large specimens, sparse on some small animals; tubercles absent and branchiostegites merely punctate on most specimens <20 OCL. 2-5 cervical spines, medium-sized or small (tiny on some <20 OCL) and moderately pointed or blunt, though dorsalmost spine sometimes sharp.

Ar1/OCL 0.34-0.39. ArW/OCL 0.15-0.22 d. CaW/OCL 0.49-0.55. CaD/OCL 0.46-0.51 d.

**Abdomen:** Somite 1 lacking spines. Somite 2 of specimens >20 OCL and some smaller animals with 4-9 Li spines per side, spines medium-sized to tiny and sharp to blunt; tiny Li spine usually on somites 3 and 4 of large specimens but vague or absent on somites 5 and 6. Specimens <20 OCL lacking spines or with 2-6 tiny Li spines on somite 2 and occasionally 1 spine on somite 3. Lii spines usually absent (one medium-sized specimen with tiny Lii spine on somite 5). D-1 and D spines absent on all specimens. Dorsal boss absent.

AbdW/OCL (0.44)0.46-0.53 i. OCL/l 0.37-0.41 i.

**Tailfan:** Tailfan spines absent though setal bumps obvious on margins of telson and uropods. Standard spines medium-sized.

Tel., OCL 0.34-0.44 d.

**Chelae:** Chelae intermediate to elongate in shape. Teeth well developed on specimens >30 OCL.

**Propodus:** Usually 2 lateral propodal spine rows except on very small specimens with only dorsal row; ventral row usually commencing third to half propodal length from base, i.e. proximal half of propodus often with single row. Lateral spines small to medium-sized and rather sharp. Outer spine ridge weak or absent. 5-6 mesal propodal spines; 2-4 (rarely 1) dorsal apical propodal spines on specimens >20 OCL, frequently absent on smaller specimens. 4-6 spines above propodal cutting edge of



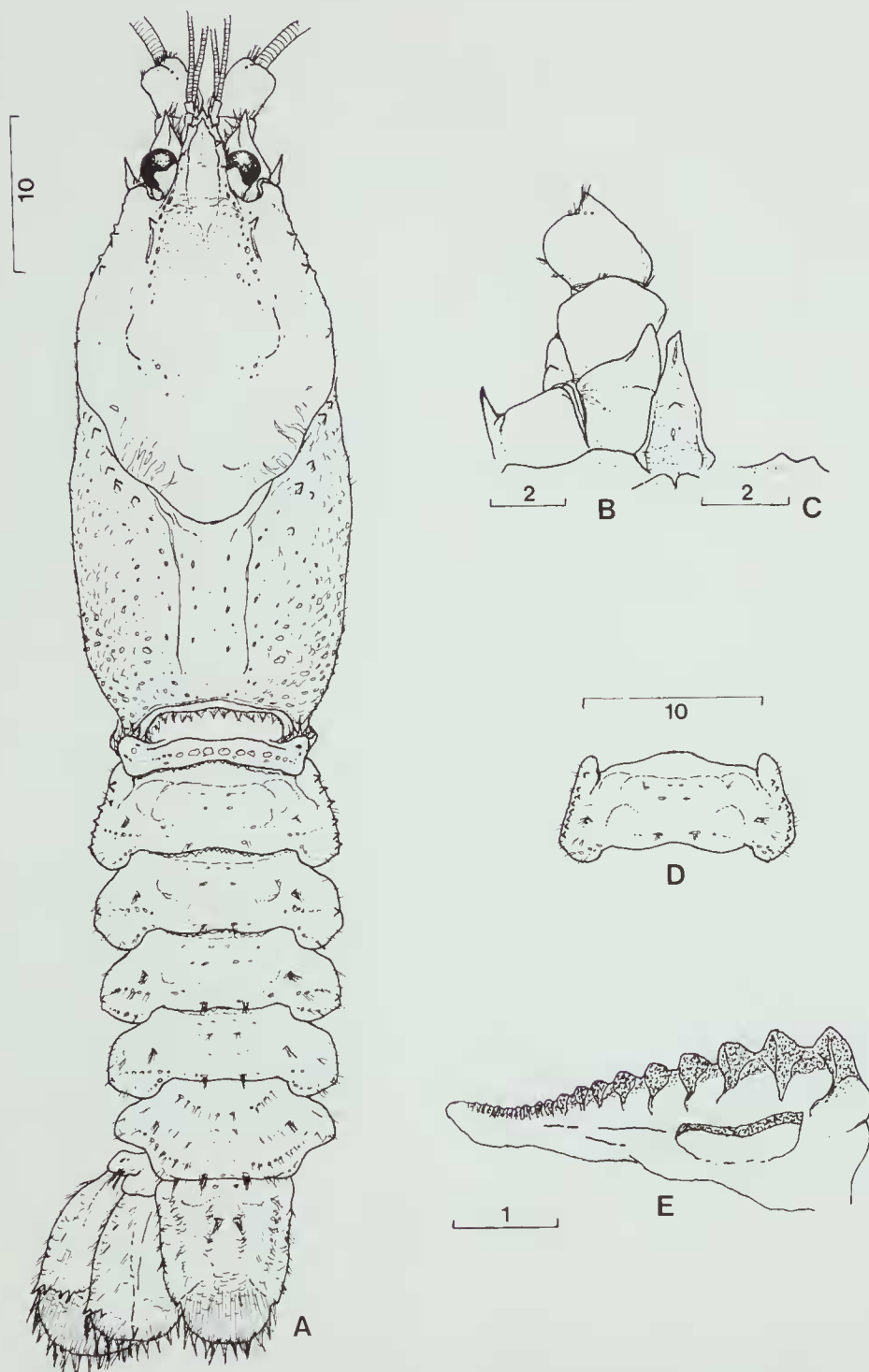


Figure 5. *Euastacus eungella*. A, dorsal view (holotype ♂, Cattle Ck, QM W10980); B, ventral view cephalon (holotype ♂); C, weakly bifid coxopodite spine (paratype ♂, Cattle Ck, QM W10981); D, abdominal somite 2: more numerous and smaller Li spines (paratype ♂); E, zygocardiac ossicle (holotype ♂).

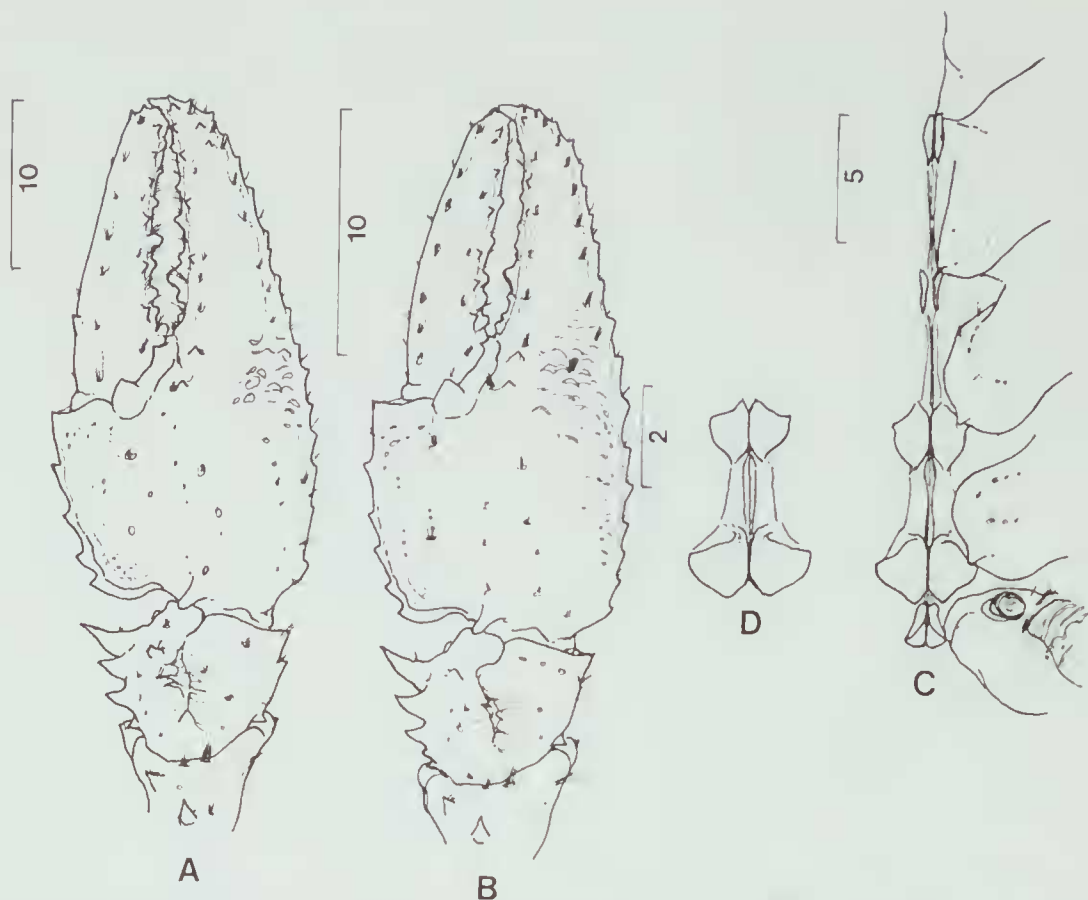


Figure 6. *Euastacus eungella*. A, dorsal view chela (holotype ♂); B, chela: 3 (+ 1) mesal carpal spines, 6 mesal propodal spines, mesal dactylar basal spines absent, 1 apical propodal spine (allometry) (paratype ♀, Cattle Ck, QM W10981); C, sternal keel (holotype ♂); D, keel Pr3 and 4: broader (allometry) (paratype ♀).

specimens >30 OCL, 1-5 on specimens 20-30 OCL; spine row usually reaching proximal to midlength or to full gape of chela, often reaching spines lateral to dactylar base dorsally, though apical or absent on specimens close to or slightly <20 OCL; spines large to small. Dorsally, 1-2 medium-sized or small spines lateral to dactylar base, with several small outer bumps or spines; ventrally, 1-2 medium or small spines. Spines absent proximal to dactylar articulation; precarpal spines absent except on some regenerate chelae.

PropL/OCL 0.92-1.02. PropW/PropL 0.41-0.48 id. PropD/PropL 0.25-0.30 id.

Dactylus: Row of 3-8 spines above dactylar cutting edge of specimens >20 OCL and 3-4 on smaller specimens, reaching proximal to midlength or to full gape; spines medium-sized or small, usually largest basally. Extra dorsal dactylar spines absent. 0-2 dorsal mesal basal spines, medium-sized and quite sharp. Marginal mesal basal spines absent. 1-3 apical mesal spines. Dactylar groove usually inconspicuous on large specimens, deep on some specimens <30 OCL.

DactL/PropL 0.48-0.59 i.

Carpus: Dorsolongitudinal groove deep. 3 or 3 (+ 1) mesal carpal spines, distalmost largest and definitely offset ventrally. 2-3 outer carpal spines, small to medium-sized on specimens <30 OCL, sometimes large on larger specimens. Articulation spine tiny or absent, medium-sized on some specimens <20 OCL. Usually 1-2 small blunt dorsal carpal spines. Ventral spine large or medium/large (small on some very small individuals); ventromesal spines numbering 2-3, largest medium-sized or small (always smaller than ventral spine).

Merus: 7-10 dorsal meral spines, medium-sized or small. Outer spine small.

Keel: Pr1: Posterior margin sloped or almost semi-abrupt (semi-abrupt on some specimens <20 OCL); profile usually angled down, sometimes flat or rounded; processes close and parallel. Keel after Pr1 lacking spines, sometimes slightly bumped.

Pr2: Approximately parallel and apart. Keel after Pr2 moderately pronounced without spines.

Pr3: Scoops absent (rarely very gradual); posterior edges moderately sharp to sharp; configuration almost parallel on some small specimens. Keel after Pr3 moderately pronounced and often irregular on large specimens, very pronounced on specimens <20 OCL.

Pr4: Scoops absent; posterior edges moderate to sharp and slightly convex; anterior edges moderately rounded to very angular.

Processes 3 and 4 narrow on specimens >20 OCL, broad on some smaller crayfish.

*Setation*: Moderate to light.

*Punctuation*: Moderate to sparse on cephalon; moderate to dense on thorax.

*Gastric mill*: TAP count 3.5-4.0; TAA count 1.0-1.5; spread 2.0-3.0. Urocardiac ridges 6. Urocardiac ossicles rather shallow.

*Coloration*: Body green/blue dorsally, sometimes tinged with purple, paler ventrolaterally. Usually pale patches on dorsal and lateral cephalon; cephalic spines dark blue. Rostral spines pale. Abdomen often bluer than cephalothorax, somites bright blue laterally. Carpus of cheliped blue/green, mesal spines bright blue/purple, lateral spines white. Propodus and dactylus blue/purple. Fingertips pale yellow.

Body bright blue ventrally, with patches of orange and cream. Propodus of cheliped blue mesally, mesal spines blue/white, white on fingers, orange patch lateral to dactylar base. Dactylus pale blue or purple, white distally.

Variation between individuals in tones of blue and purple. Very small specimens pale brown or green.

*Sexes*: Males possess a cuticle partition.

No mature females have been collected. Female maturity presumably occurs at lengths greater than 30 OCL.

*Distribution and biology*. The species appears restricted to elevations above 740 m a.s.l. in the Clarke Range, in and near Eungella National Park, approximately 65 km west of Mackay, central coastal Queensland. The area is drained primarily by the Pioneer River. Vegetation in the species' range is tropical rainforest. The largest specimens were collected from a seepage at the type locality. The Eungella plateau is much higher than areas within 240 km to the north and 500 km to the south, and receives over 2400 mm of rainfall annually. The species is sympatric with a species of *Cherax* at the lower Eungella sites.

*Etymology*. Named after "Eungella" (Land of Cloud), the National Park on the Clarke Range, west of Mackay. The name is probably derived from the Biria aboriginal language (Dixon, 1972).

*Remarks*. *Euastacus eungella* has been collected only from a small area and does not display marked geographical variation.

The species is represented in collections by only 12 complete or near complete specimens with only one larger than 30 OCL. Two chelac, presumably

from the same animal, are present in the QM collection and were undoubtedly borne by a specimen larger than 40 OCL. The propodus, dactylus and merus of a single large cheliped (mementos of a Park Ranger) were examined and measured, and also must have belonged to an animal larger than 40 OCL. Extrapolation of PropL/OCL ratios to the propodal lengths of the larger of the two museum chelae (45.5 mm) and the Ranger's specimen (46.8 mm) imply OCLs of 48-50 mm. Large specimens have been observed occasionally in the field (K. McDonald, pers. comm.).

### *Euastacus fleckeri* (Watson)

Figures 7, 8

*Astacopsis fleckeri* Watson, 1935: 233-235, pl.34. — Watson, 1936: 52. — Flecker and Flecker, 1936: 18.

*Euastacus fleckeri*. — Clark, 1936: 17-18, pl. 3, fig. 17. — Clark, 1937: 186. — Clark, 1941: 19-20. — Riek, 1951: 378-379, 381. — Riek, 1969: 895.

*Material examined*. Holotype. Qld, Roots Ck near Mt Carbine in Mt Molloy district, 80 miles (130 km) west of Cairns, QM W581, ♂, OCL 102.8 mm. (There is some confusion regarding the identity of the type specimen. The male W581 is present in the jar bearing the type locality and holotype label. Watson (1935) originally designated the holotype as male, and Flecker and Flecker (1936) recorded the type as male. In a copy of the *Memoirs of the Queensland Museum* seen by me Watson's (1935) designation of the type as "male" has been amended by an unknown person to "female". Clark (1936) and Riek (1969) recorded the holotype as female and a female (QM W620, OCL 119.1 mm) also bears a type locality label. It is concluded here that the holotype is the male QM W581 and that confusion regarding sex has occurred subsequent to Watson's (1935) description.)

Other specimens. Qld. Mt Lewis near Cairns, P. Flecker, AM P13434, 2♂, 1♀; Mt Lewis, P. Flecker, AM P15528, 1♂; Leichhardt Ck tributary, cement road crossing above old forestry camp, Mt Lewis, (16°35'S, 145°19'E), 6 Jul 1981, G.J. Morgan and S.J. Harders, QM W10988, 2♀; Leichhardt Ck tributary beside old forestry camp, Mt Lewis, (16°35'S, 145°19'E), 7 Jul 1981, G.J. Morgan and S.J. Harders, QM W10988, 2♀; Head of Mossman R., 3 Jan 1936, A. Flecker, QM W608, W610, W612, W617, W619, W621, 6♀; North Queensland, QM W1469, 1♀. (The AM registry lists a "topotype" AM P10758 but this specimen could not be found. In any case, its locality of "upper reaches of Mossman R., north of Cairns" does not agree strictly with the type locality.)

*Diagnosis*. Male cuticle partition usually absent (see *Remarks*). Rostrum distinctly U-shaped (especially on large specimens) with sides parallel and base divergent. Rostral marginal spines in line reaching, or extending proximal to, midlength of carinae. Antennal squame widest at midlength, spines ab-

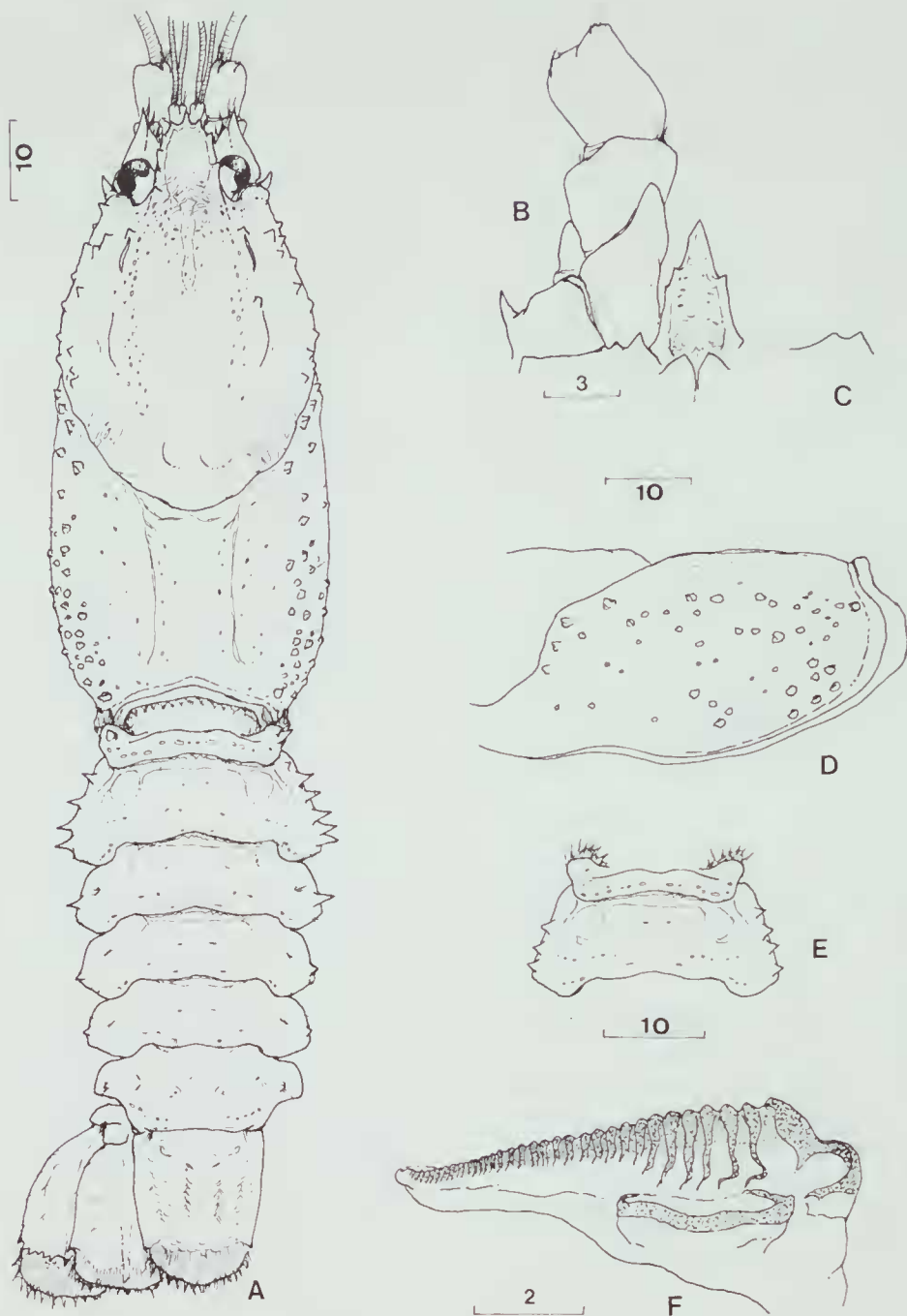


Figure 7. *Euastacus fleckeri*. (Types not available at time of illustration) A, dorsal view (♀, Mossman R., QM W619); B, ventral view cephalon (♀, Mossman R.); C, bifid coxopodite spine (♀, Mt Lewis, AM P13434); D, lateral view thorax (♀, Mossman R.); E, abdominal somites 1 and 2: D-L spine absent from somite 1, fewer blunter Li spines on somite 2 (♀, Leichhardt Ck, QM W10988); F, zygocardiac ossicle ("topotype", Mossman R., AM P10758, Francois collection).



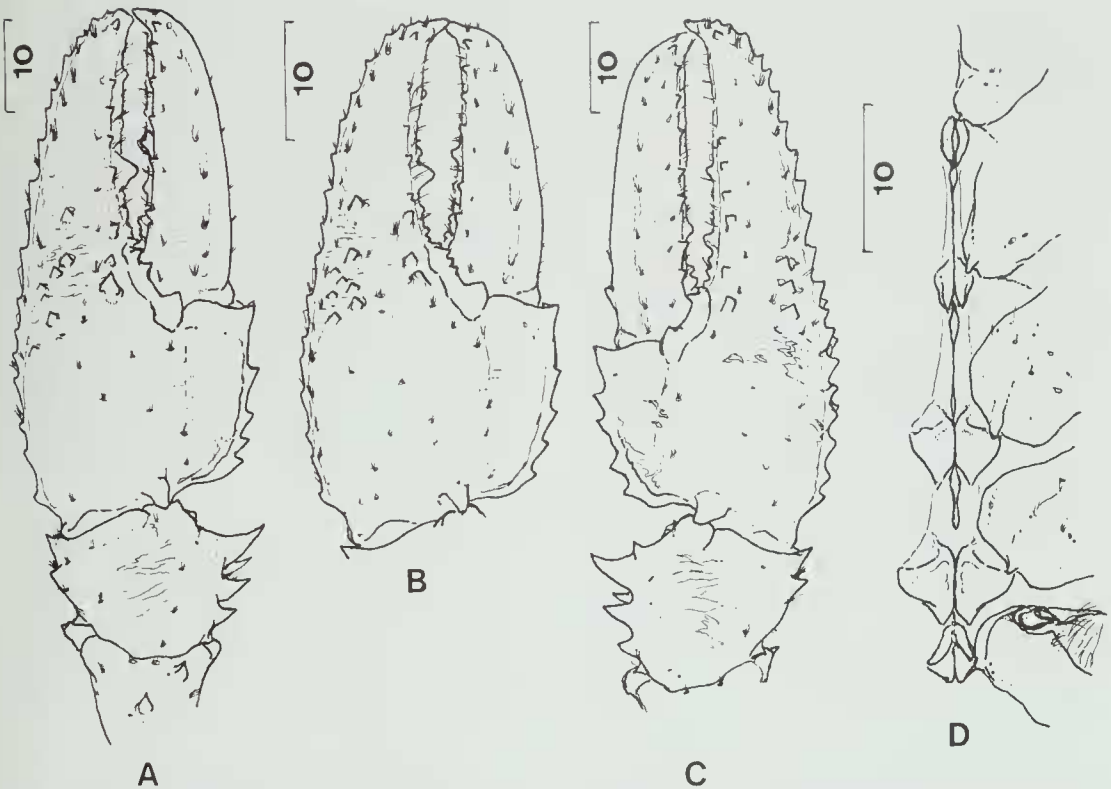


Figure 8. *Euastacus fleckeri*. A, dorsal view chela (♀, Mossman R.); B, chela: stouter (♀, Leichhardt Ck); C, chela: 4 mesal carpal spines, dactylar basal spine (regenerate) (♂, Mt Lewis, AM P13434); D, sternal keel (♂, Mt Lewis).

sent. Suborbital spine small to medium-sized. Thoracic spines/tubercles largest dorsally and very sparsely distributed over branchiostegites (vague on some specimens <40 OCL). D-L spine usually present on abdominal somite 1 (and rarely somite 6). D abdominal spines and abdominal boss absent. Tailfan spines absent. Lateral propodal spines in 2 to 1 row condition (ventral row poorly developed). 4-5 (rarely 6) mesal propodal spines. 0 or 1 dorsal apical propodal spine. Spines above propodal and dactylar cutting edges in rows reaching proximal to midlength of gape. Mesal dactylar spines absent. Carpal dorsal groove shallow. 3-4 (rarely 5) mesal carpal spines. Large mesoventral carpal spine. Keel Pr1 usually angled down and close. Pr3 and 4 narrow or just broad. TAP count 8.0-9.5.

**Description.** Maximum OCL: 119.1 mm.

**Rostrum:** Rostrum rather short, not reaching midlength of 3rd antennal segment on specimens >20 OCL, reaching midlength on specimens <20 OCL. Rostral sides approximately parallel, base divergent or very divergent and

carinae short and spread. 3-4 (rarely 5) marginal spines per side, distributed to or proximal to midlength or full length of carinae; spines medium-sized or small and usually moderately pointed, blunt on some large specimens (probably abraded), rather sharp on some specimens <60 OCL. Acumen spine subequal to, or slightly larger than, marginal spines.

OCL/CL 0.82-0.89 i. RW/OCL 0.15-0.21 d.

**Cephalon:** Cephalon moderately spiny or spiny, with numerous small spines below postorbital ridges, or poorly spined on specimens <40 OCL. 1st postorbital spine an edge on specimens >80 OCL, small on some lesser individuals and medium-sized on some crayfish <40 OCL; 2nd spine small edge to small, sometimes on one side only. Suborbital spine small or medium-sized. Lateral margin of squame approximately straight; squame widest at midlength; marginal spines usually absent (one large specimen with lateral spine on both squames). Interantennal spine elongate on specimens >100 OCL, medium width on specimens 60-100 OCL, medium or broad on smaller specimens; spine margin scalloped or toothed; centre frequently punctate. Antennal basipodite spine absent; coxopodite spine medium-sized or small and bifid or serrated, usually pronounced mesally.

ScL/OCL 0.11-0.20 d.

**Thorax:** On specimens >40 OCL, small, moderately sharp to blunt spines or tubercles scattered irregularly over branchiostegites; spines larger and denser dorsally. Carapace sides lightly punctate. Specimens <40 OCL usually devoid of carapace ornamentation. 2-4 cervical spines; spines medium-sized or small and sharp or moderately pointed, tiny and blunt on some specimens <40 OCL; spines usually evenly spaced and similarly sized.

ArL/OCL 0.37-0.40. CaW/OCL 0.52-0.58. ArW/OCL 0.14-0.24 d. CaD/OCL 0.45-0.50 d.

**Abdomen:** Small or tiny D-L spine on somite 1 of specimens >60 OCL and some smaller animals; spine usually blunt, sometimes rather sharp. Subsequent somites lacking D-L spines (somite 6 of one very large specimen with tiny bump). D abdominal spines absent. Somite 2 with 3-6 Li spines on specimens >40 OCL, 2 or 3 spines on smaller specimens; somites 3-5 of specimens >40 OCL and some 20-40 OCL with single Li spine; Li spines large to small on specimens >60 OCL, medium-sized to tiny on lesser animals, decreasing posteriorly; spines very sharp or sharp on animals >40 OCL, moderately pointed to blunt on smaller crayfish. Lii spines on somites 3-5 of some large crayfish, spines small or tiny and moderately pointed to blunt; tiny Lii spine on somite 6 of most specimens >60 OCL. Abdominal boss absent.

AbdW/OCL ♂ 0.49-0.54 d, ♀ 0.52-0.56 i. OCL/L 0.37-0.46 i.

**Tailfan:** Tailfan spines absent; faint setal bumps along margins of telson and uropods. Standard spines very small or small, medium-sized on smallest specimen.

Tel/OCL 0.34-0.41 d.

**Chelae:** Chelae elongate to stout (elongate chelae probably regenerate). Teeth well developed on very large specimens.

**Propodus:** Lateral propodal spines in 2 to 1 row condition, ventral row often poorly developed; spines medium-sized or small and rather sharp. 1 lateral spine ridge vague or absent. Usually 5 mesal propodal spines, rarely 4 or 6. 0 or 1 dorsal apical propodal spine. 2-6 spines above cutting edge of specimens >40 OCL, 1-3 on specimens 20-40 OCL, spines absent on animal <20 OCL; spine row extending proximal to midlength or full gape of chela, usually with distinct gap between propodal apex and distalmost spine; spines small to large, usually largest proximally, near dactylar articulation. Dorsally, 1 or 2 medium-sized spines lateral to dactylar base, with 3-7 or more lateral blunt spines often forming irregular row parallel to propodal lateral edge; ventrally, 2-4 medium-sized or small spines, very close to cutting edge. Spines absent proximal to dactylar articulation; precarpal spines absent.

PropL/OCL ♂ 0.84-0.97 i, ♀ 0.83-0.91 i. PropW/PropL (0.34)0.38-0.52. PropD/PropL (0.23)0.25-0.39 d.

**Dactylus:** 6-9 spines above dactylar cutting edge on specimens >40 OCL, 1-2 spines on smaller specimens; spines distributed along full gape of chela (smallest animal with single basal spine); spines medium-sized to large. Extra dactylar dorsal spines absent. Apical and basal mesal dactylar spines absent (two specimens with single

marginal basal spine on regenerate chelae). Dactylar groove absent or shallow on specimens >40 OCL, distinct on some smaller specimens.

DactL/PropL 0.53-0.61.

**Carpus:** Dorsolongitudinal groove very shallow. 3-4 (rarely 5) mesal carpal spines; 1st (distal) spine usually smaller than 2nd. 2 lateral carpal spines, medium-sized to large. Articulation and dorsal carpal spines absent. Ventral carpal spine medium-sized, rarely large. Large mesoventral spine larger than ventral spine, and usually 2-3 ventromesal spines, 1 of which sometimes also large.

**Merus:** 5-9 dorsal spines, small or medium-sized. Outer spine small or tiny.

**Keel:** Pr1: Posterior margins very sloped; ventral edges angled down or slightly angled back near anterior margins; processes close (or very slightly apart) and closed or parallel. Keel after Pr1 sometimes with slight spine.

Pr2: Usually open or very open, occasionally parallel; processes apart. Keel after Pr2 slightly pronounced or saddle-shaped.

Pr3: Scoops absent or gradual; posterior edges moderate to rounded (sharp on smallest specimen). Keel after Pr3 moderately pronounced anteriorly.

Pr4: Scoops absent; posterior edges moderate to moderately sharp (sharp on smallest specimen) and straight, slightly convex or irregular; anterior edges moderate to angular.

Processes 3 and 4 narrow or just broad on specimens >60 OCL, broad on smaller animals.

**Setation:** Light.

**Punctuation:** Moderate to dense, but faint, on cephalon; dense on thorax.

**Gastric mill:** TAP count 8.0-9.5; TAA count 0.0; spread 8.0-9.5. Teeth small and close. Urocardiac ridges 8-10.

**Coloration:** Body very dark green with brown tinges dorsally, deep blue ventrolaterally. Thoracic and cephalic spines red or orange. Rostral carinae orange. Anterior margins of abdominal somites bright blue (visible when abdomen flexed). Li spines red. Carpus of cheliped blue/green with red tipped spines. Propodus dark blue/green with some mottling, red spines, mesal edge blue. Dactylus green/red. Finger tips red.

Body light blue and red ventrally. Carpus of cheliped bright blue with red spines. Propodus blue, greener at mesal edge, red spines.

**Sexes:** Most males lack a cuticle partition but one specimen possesses a thin partition (see *Remarks*).

One female in the 40-60 OCL range displays open gonopores, though 2 specimens in the 60-80 OCL range are unopen. All females are mature when >80 OCL.

**Distribution and biology.** The species occurs in rainforest streams at elevations above 1000 m a.s.l. in a small area west of Mossman, north Queensland, from Mt. Lewis in the south to the Mt Spurgeon region in the north, a distance of 20 km. The high country is drained by the Mossman River to the east and tributaries of the Mitchell River to the west and south. Creeks are well shaded and log and leaf litter are abundant. Lower country between Mt

Lewis and Kuranda separates *E. fleckeri* from *E. balanensis* of the Atherton Tableland. Streams in this lower area support species of *Cherax*, *Macrobrachium* and *Atyoida*.

**Remarks.** Of the four males examined, three lack the coxal cuticle partition and one medium-sized specimen possesses it. Two of the former three males are large (>60 OCL) but the third is small (<20 OCL); hence it cannot be argued that the partition breaks down with age. Further sampling may reveal that the specimen with a partition is aberrant and atypical of the species, but the inconsistency cannot be resolved at this stage.

### *Euastacus hystricosus* Riek

Figures 9, 10

*Euastacus hystricosus* Riek, 1951: 380-381. — Riek, 1956: 1-2. — Riek, 1969: 896.

**Material examined.** Qld. Elaman Ck, Maleny, 8 Oct 1953, E.F. Riek, AM P13044, 2♂, 4♀; Mary R., 1974, QM W4643, 1♂; Conondale Ra., QM W2027, 1♂; Conondale, 25 Apr 1943, AM P11932, 2♀; Sunday Ck, Kilcoy, QM W1988, 1♂, 1♀; Kondalilla Nat. Park, Aug 1974, QM W5457, 1♀; Tributary of Little Yabba Ck, Kenilworth State Forest, (26°39'S, 152°37'E), 10 Mar 1981, G.J. Morgan and S.J. Harders, QM W10965, 1♂; Six Mile Ck, Kenilworth S.F., (26°46'S, 152°36'E), 11 Mar 1981, G.J. Morgan and S.J. Harders, QM W10966, 1♂; Sunday Ck, Kenilworth S.F., (26°44'S, 152°32'E), 12 Mar 1981, G.J. Morgan and S.J. Harders, QM W10962, 1♂; Kilcoy Ck at Rum Crossing, tributary Brisbane R., (26°46'S, 152°36'E), 13-14 Mar 1981, G.J. Morgan and S.J. Harders, QM W10963, 1♂, 2♀.

**Diagnosis.** Male cuticle partition present. Rostral marginal spine row reaching proximal to midlength of carinae. Rostral base parallel to divergent, carinae of medium length to long. Antennal squame widest at or slightly proximal to midlength. Squamal spines absent. Suborbital spine usually large or very large. Thoracic spines medium-sized, in zone or irregular rows. General tubercles medium-sized or large, moderately to sparsely distributed. 3-4 large and sharp Li spines on abdominal somite 2 (>40 OCL). Several sharp D spines on abdominal somites 5 and 6 (>40 OCL). Abdominal boss present. 8-15 large telsonic surface spines. Marginal spines present on outer ramus of uropod. Lateral propodal spines in 2 to 1 row condition. 1 dorsal apical propodal spine (>40 OCL). Spines above propodal cutting edge usually apical (row sometimes reaching to or slightly proximal to midlength of gape). Usually 5 mesal propodal spines. Spines above dactylar cutting edge apical or in row reaching proximal to midlength of gape.

1 dorsal mesal dactylar basal spine. 1-3 marginal mesal dactylar basal spines. 3-4 apical mesal dactylar spines. Dorsolongitudinal groove of carpus deep. 2 mesal carpal spines. Ventromesal carpal spines much smaller than ventral spine. Keel Pr1 abrupt and apart. TAP count 5.0-6.0. [Usually 2 distinct spines on each side of epistome].

**Description.** Maximum OCL 138.6 mm.

**Rostrum:** Rostrum not reaching or just reaching midlength of 3rd antennal segment on specimens >60 OCL, to or distal to midlength of segment on specimens 40-60 OCL, distal to midlength or to end of segment on smaller animals. Rostral sides parallel or slightly convergent, base parallel to divergent, usually slightly divergent. Carinae medium length to long, not markedly spread. Rostral marginal spines numbering 3 (rarely 2)-4 per side, in row reaching proximal to midlength of carinae; spines medium-sized to large and moderately sharp. Acumen spine slightly larger to much larger than marginal spines.

OCL/CL 0.73-0.87 i. RW/OCL 0.15-0.23 d.

**Cephalon:** Rather poorly spined to spiny, usually with 1 or 2 large, sharp spines ventral to postorbital ridge with some smaller spines/bumps. First postorbital spine small to medium-sized on specimens >100 OCL, usually large or very large on specimens <80 OCL. 2nd postorbital spine an edge on very large specimens, usually small or medium-sized on specimens 60-80 OCL and large on smaller specimens. Suborbital spine medium/large to very large. Lateral margin of squame convex to straight; squame widest at or slightly proximal to midlength on specimens >40 OCL, distinctly proximal on smaller animals; marginal spines absent. Interantennal spine of medium width to broad, marginally serrated or slightly (rarely distinctly) toothed. Antennal basipodite spine medium-sized to large on most specimens >60 OCL (largest specimen with only small spine) and large or very large on specimens <60 OCL. Coxopodite spine small to medium-sized, rarely large, usually bifid, occasionally serrated, with mesal point most pronounced.

ScL/OCL 0.13-0.33 d.

**Thorax:** On specimens >40 OCL, 8-14 dorsal thoracic spines in zone or 2 irregular rows. Spines medium-sized to medium/large and usually sharp, especially near posterior of carapace, with moderate or blunt spines dorsally. Larger specimens in 20-40 OCL range with medium-sized or small, blunt, rounded or flat spines. Spines vague or absent on specimens close to or <20 OCL. General tubercles medium-sized to large on specimens >40 OCL, moderate to sparse in density. Specimens <40 OCL with very small to medium-sized, very sparse tubercles; on very small animals, tubercles vague or absent. Usually 1 sharp, medium to very large cervical spine, though 2nd smaller spine sometimes present on small animals.

ArL/OCL 0.38-0.41. CaW/OCL 0.58-0.64 i. ArW/OCL 0.12-0.19 d. CaD/OCL 0.51-0.57 d.

**Abdomen:** Sharp, medium-sized or large D-L spine on somite 1 of specimens >40 OCL (tiny spine on some smaller animals; one medium-sized specimen with 2 D-L spines on one side). D spine absent on somite 1. 3-4 Li



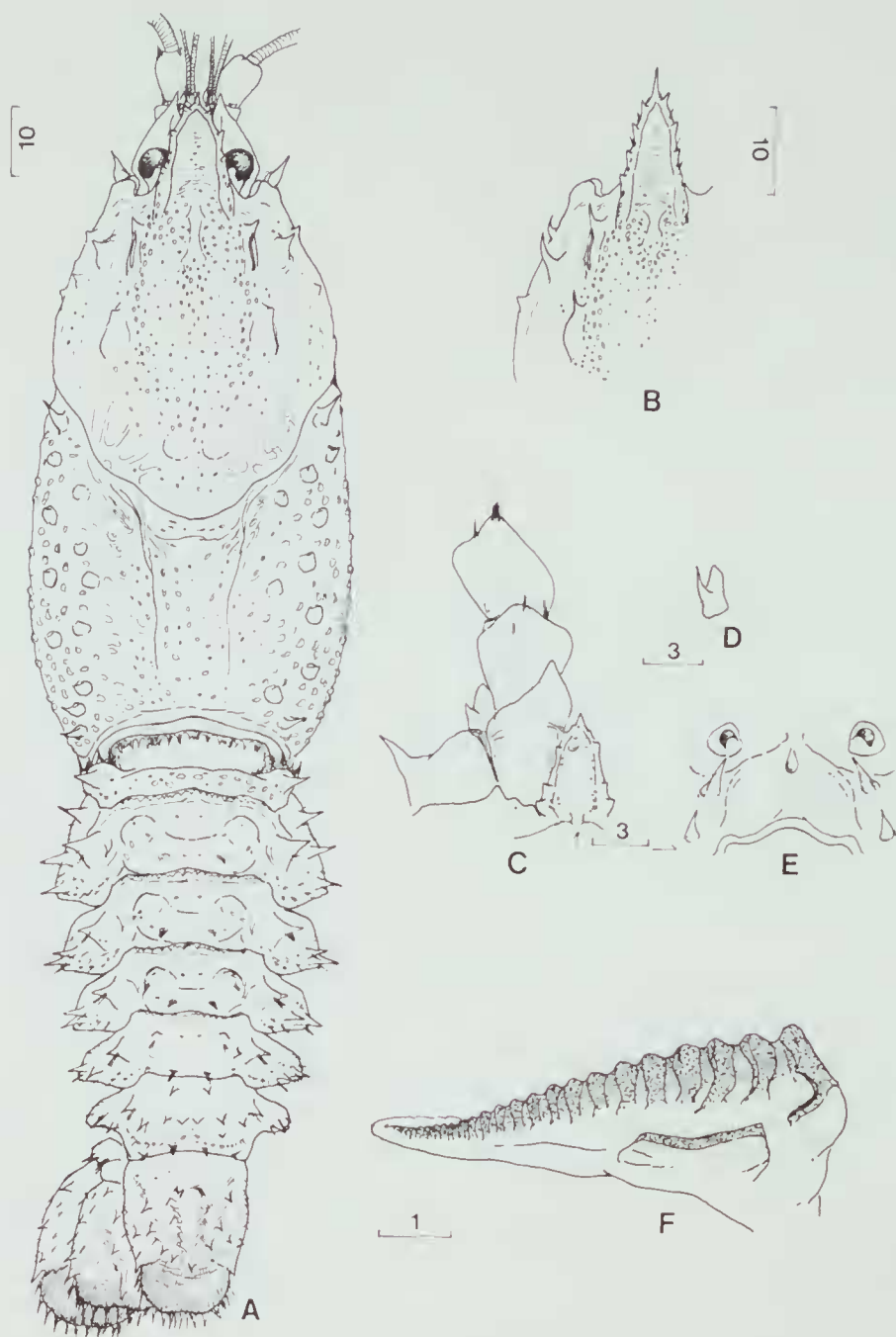


Figure 9. *Euastacus hystricosus*. (Types not available for illustration). A, dorsal view ( $\sigma$ , tributary of Little Yabba Ck, QM W10965); B, cephalon: rostrum more elongate with more numerous spines, larger cephalic spines, (allometry) ( $\sigma$ , Sunday Ck, QM W10962); C, ventral view cephalon ( $\sigma$ , tributary of Little Yabba Ck); D, very large basipodite spine (allometry) ( $\sigma$ , Six Mile Ck, QM W10964); E, epistome: 2 large spines per side ( $\sigma$ , Sunday Ck); F, zygocardiac ossicle ( $\phi$ , Maleny, AM P13043, Francois collection).



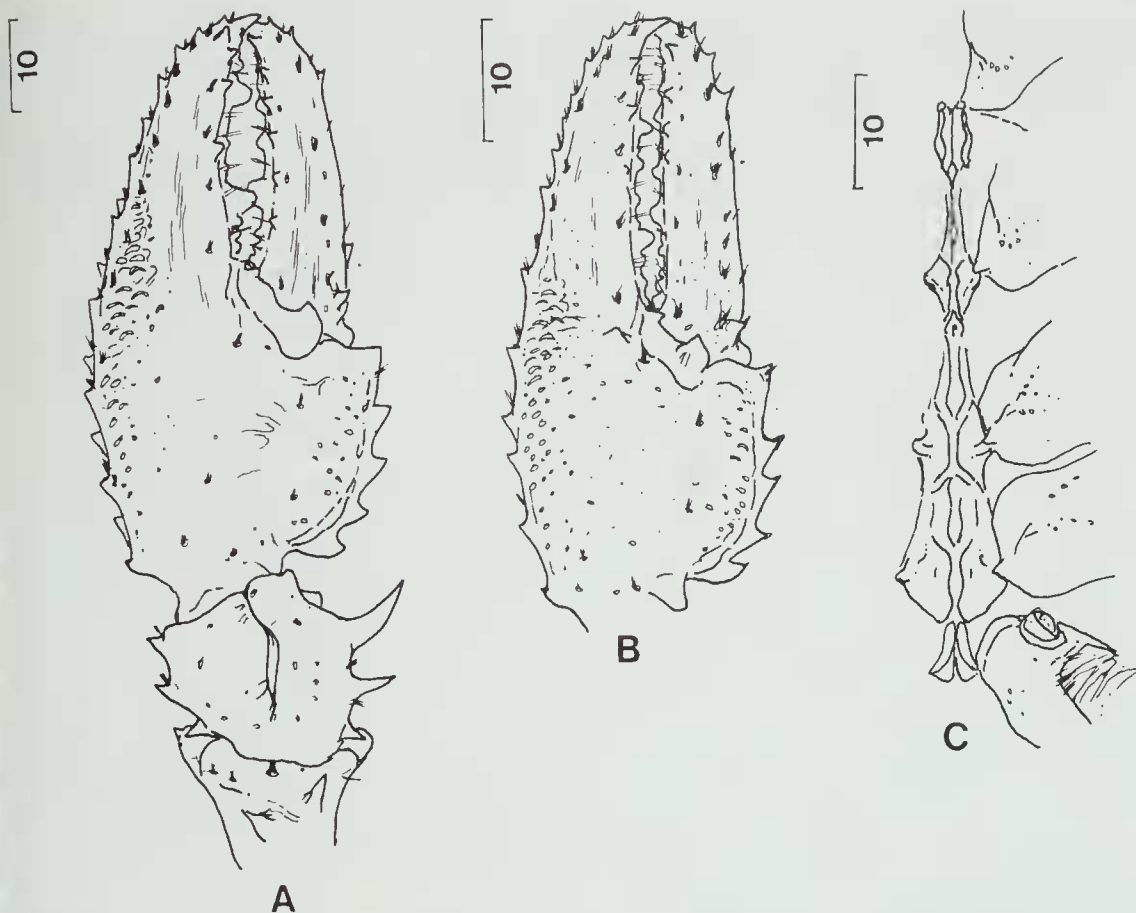


Figure 10. *Euastacus hystricosus*. A, dorsal view chela (♂, tributary of Little Yabba Ck); B, chela: more elongate (allometry), marginal mesal dactylar basal spine absent, apical propodal spine absent, small spine lateral to dactylar base (♂, Six Mile Ck); C, sternal keel (♂, tributary of Little Yabba Ck).

spines on somite 2 of specimens >40 OCL and 2-3 spines on most specimens 20-40 OCL. Somites 3-5 with single Li spine (outer Lii spine on somite 6 approaching Li position). Li spines very sharp and very large or large on anterior somites of specimens >40 OCL, decreasing in size posteriorly. On smaller specimens, Li spines medium-sized to tiny and sharp to very blunt. Somites 3-6 of specimens >40 OCL and some smaller animals with 1-2 Lii spines per side. Lii spines very large to medium-sized on specimens >60 OCL, medium to small on specimens 40-60 OCL and small or tiny when present on smaller animals; Lii spines very sharp, or blunt on specimens 20-40 OCL. 1 D-L spine on somites 2-5 of specimens >40 OCL; vague or absent on smaller specimens. D-L spines very large to medium-sized, decreasing to posterior, and very sharp. D spine absent from somites 2-4, distinct boss sometimes approaching blunt spine condition. On somite 5, 1-2 small D spines sometimes present. Somite 6 of specimens >40 OCL with 2-4 D-L and 3-5 D spines. Spines medium-sized or small, very sharp to moderately pointed.

Spines vague or absent on specimens 20-40 OCL. Specimens <20 OCL probably lacking abdominal spination. AbdW/OCL ♂ 0.48-0.56 d, ♀ 0.55-0.61 i. OCL/L 0.36-0.44 i.

**Tailfan:** 8-15 dorsal telsonic surface spines. Spines very large or large on specimens >40 OCL, often medium-sized on specimens 20-40 OCL. Marginal telsonic spines usually absent, though 1 large spine sometimes present on 1 or both telsonic margins. 1-3 surface spines on inner ramus of uropod, spines very large or large on specimens >40 OCL, medium-sized or small on smaller animals. 2-6 large marginal spines on inner ramus of specimens >40 OCL and on some smaller individuals. 3-6 marginal spines on outer ramus of uropod of specimens >40 OCL; on smaller animals, spines medium-sized or small when present, vague or absent on some very small specimens. Standard telsonic spines small to medium-sized on specimens >100 OCL, medium to large on smaller specimens. Frequently large spine on base of uropods.

Tel/OCL ♂ 0.33-0.40 d, ♀ 0.38-0.43 d.

**Chelae:** Chelae of specimens >40 OCL rather stout to elongate, sometimes very elongate on smaller animals. Teeth well developed on most specimens >60 OCL.

**Propodus:** Lateral propodal spines in 2 to 1 row condition, ventral row often poorly developed on very small specimens. Lateral spines medium-sized to large, usually sharp. Lateral spine ridge present. Usually 5 mesal propodal spines, though distalmost spine often poorly developed. Usually 1 dorsal apical spine on specimens >40 OCL, absent on smaller animals. 2-5 spines above propodal cutting edge on specimens >40 OCL; spines medium-sized or large and usually apical, spine row sometimes reaching to midlength (rarely slightly proximal to midlength) of gape. On specimens 20-40 OCL, 0-2 medium or small apical spines above cutting edge. 0-1 spine lateral to dactylar base dorsally; when present, spine large to small; lateral propodal bumps weakly developed. Ventrally, 1-3 large to small spines lateral to dactylar base (spine rarely absent). Spines absent proximal to dactylar articulation; precarpal spines absent.

PropL/OCL  $\sigma$  0.90-1.06  $\text{f}$ ,  $\text{f}$  0.86-0.95.  
PropW/PropL (0.33) 0.35-0.44  $\text{id}$ . PropD/PropL 0.22-0.26.

**Dactylus:** 4-7 spines above cutting edge of dactylus of specimens >60 OCL, 2-5 spines on specimens 40-60 OCL, 0-3 on animals 20-40 OCL. Spines large or medium-sized, and apical or in row reaching to or proximal to midlength of gape. One very large specimen with extra dorsal dactylar spine on larger chela. 1 dorsal mesal basal spine on all specimens. Usually 1-3 marginal mesal basal spines; some specimens (especially small animals) lacking spines on one chela and one large animal with 4 on its smaller (probably regenerate) chela. Basal spines medium-sized or large and usually very sharp. 3-4 apical mesal spines. Dactylar groove absent or vague on specimens >40 OCL, light on smaller specimens.

DactL/PropL 0.52-0.58.

**Carpus:** Dorsolongitudinal groove deep. 2 mesal carpal spines; distalmost (1st) distinctly larger and slightly offset ventrally to 2nd. Two lateral carpal spines, medium-sized or large. Articulation and dorsal carpal spines absent. Ventral spine very large. 1 (rarely 2) small or tiny ventromesal spine(s).

**Merus:** 6-9 large dorsal meral spines. Outer spine medium-sized on specimens >40 OCL, large or very large on smaller individuals.

**Keel:** Pr1: Posterior margin abrupt (semi-abrupt on some small specimens); ventral profile usually irregular and rounded, flat, angled down or slightly back. Processes apart or very apart and parallel or closed. Keel after Pr1 frequently with spine.

Pr2: Open or very open. Keel after Pr2 usually pronounced anteriorly, sometimes with low spine.

Pr3: Distinct scoops; posterior margin usually rounded, though some specimens <40 OCL with moderately sharp processes. Keel after Pr3 pronounced and uneven in profile and moderate to sharp.

Pr4: Scoops usually slight, sometimes absent on small specimens. Posterior margins rounded to moderately sharp; anterior margins rounded to moderately curved on specimens >60 OCL, angular on some smaller speci-

mens. Bases usually irregular, sometimes approximately straight.

Processes 3 and 4 narrow on specimens >100 OCL, broad on smaller animals.

**Setation:** Light.

**Punctuation:** Moderate to moderately dense on large animals, dense on specimens <60 OCL.

**Gastric mill:** TAP count 5.0-6.0; TAA count 1.0-1.5; spread 3.5-4.5 (rarely 5.0). Urocardiac ridges 8-10 (number usually increasing with size).

**Coloration:** Body dark green dorsally. Thoracic spines slightly darker and general tubercles pale orange/green. Sharp abdominal and tailfan spines tipped with orange. Carpus and propodus of cheliped dark green, propodus with red, orange or yellow distally. Fingers orange and yellow.

Body orange and green ventrally. Carpus of cheliped dark green. Propodus orange grading to yellow distally, dark green mesally. Dactylus orange and yellow.

**Sexes:** Males possess a (usually wide) cuticle partition. The two males in the 40-60 OCL range collected in this study ejected spermatophores indicating sexual maturity.

Females in the 60-80 OCL size range have open gonopores, one being berried. Females in the 20-40 OCL range have closed gonopores. It is likely that female maturity occurs at lengths around 60 OCL.

**Distribution and biology.** The species inhabits streams in wet sclerophyll and rainforests at elevations above 550 m a.s.l. in the Conondale Range and Maleny areas west of Nambour, south-east Queensland. The species occurs in the Mary River system and was recently also collected from a tributary of the Brisbane River. Berried females have been observed in winter and spring. The one museum specimen with eggs was collected in August. *Euastacus hystricosus* is frequently sympatric with a species of *Cherax*, particularly at lower elevations of its range.

**Remarks.** The range and habitat of *E. hystricosus* is very limited and this large crayfish is relatively constant in morphological characters with no obvious geographical variation.

The holotype and allotype of *E. hystricosus* have been lost from the QM (fide Riek, 1969: 896) and could not be found for this study. Riek (1956: 1-2; 1969: 896) named lectotypes (including a "holotype", "allotype" and "paratypes") from Elaman Creek, Maleny (AM P13044). This move was invalid as lectotypes can be designated only from a series of syntypes. A single neotype may be nominated if the type series is lost but "only in exceptional circumstances where a neotype is necessary in the interests of stability of nomenclature" (International Code of Zoological Nomenclature, Art. 75a). It is here regarded that a neotype need not be designated for *E. hystricosus*.

***Euastacus robertsi* Monroe**

Figures 11, 12

*Euastacus robertsi* Monroe, 1977: 65-67, pl. 19.

**Material examined.** Holotype. Qld, Horans Ck, 1050 m, Mt Finnigan National Park, north-east Queensland, 27-29 Nov 1975, L. Roberts, R. Monroe and G. Ingram, QM W5323, ♂, OCL 42.3 mm.

Paratypes. Qld, type locality, QM W5324, 7♂, 11♀.

Other specimens. Qld, Horans Ck, 3500 ft, Mt Finnigan Nat. Park, 9 Nov 1974, QM W5076, 1♂; Horans Ck, 2400 ft, 10 Nov 1974, QM W5075, 1♀; Hilda Ck, Thornton Peak, 24-27 Sep 1984, G. Monteith and R. Leggett, QM W11554-W11557, 4♂, 2♀.

**Diagnosis.** Male cuticle partition present. Rostrum not distinctly U-shaped, sides usually convergent and base divergent. Rostral marginal spines in row reaching, or extending proximal to, midlength of carinae. Antennal squame widest at or slightly distal to midlength; spines absent. Suborbital spine medium-sized to large. Thoracic tubercles/spines small or very small (larger ventrally), and very sparse. D-L spine usually absent on abdominal somite 1. D abdominal spines and abdominal boss absent. Tailfan spines absent. 2 lateral propodal spine rows; 6-9 mesal propodal spines. 7-9 dorsal apical propodal spines (specimens >30 OCL). Spines above propodal and dactylar cutting edges in rows reaching full length of gape. Mesal dactylar spines absent. Dorsolongitudinal carpal groove shallow. 4-5 mesal carpal spines, distalmost often smaller than 2nd. Large mesoventral carpal spine. Keel Pr1 angled down, and close. Keel Pr3 and 4 broad or very broad. TAP count 4.5-5.0.

**Description.** Maximum OCL: 50.8 mm.

**Rostrum:** Rather short, not reaching midlength of 3rd antennal segment. Rostral sides convergent or slightly convergent, parallel on largest specimen; base divergent or very divergent and carinae short and spread. 2-4 marginal spines per side, distributed to or proximal to midlength or full length of carinae; spines medium-sized or small, rounded on specimens >30 OCL, moderately pointed or rounded on smaller animals. Acumen spine slightly larger than marginal spines.

OCL/CL 0.83-0.89 i. RW/OCL 0.14-0.20 d.

**Cephalon:** Spination moderate on specimens >30 OCL, weak on most smaller individuals, with several small spines below postorbital ridges. 1st postorbital spine an edge to small on specimens >20 OCL, small or medium-sized on specimens <20 OCL; 2nd postorbital spine edge or small edge. Suborbital spine medium-sized or large. Lateral margin of squame straight or slightly convex or concave; squame widest at or slightly distal to midlength and lacking marginal spines. Interantennal spine elongate on large specimens, medium width on animals 30-40 OCL, broad on many specimens <30 OCL; spine margin rather

smooth with 1-2 small spine(s) each side of apex, centre frequently punctate. Antennal basipodite spine absent; exopodite spine small, rarely medium-sized, and bifid or serrated.

ScL/OCL 0.14-0.19 d.

**Thorax:** Small or medium-sized tubercles or spines sparsely distributed over sides of carapace, usually larger ventrally; tubercles vague on specimens <20 OCL. 2-4 cervical spines per side, small or tiny and similarly sized and moderately pointed to blunt; spines vague or absent on specimens <20 OCL.

ArL/OCL 0.41-0.44. CaW/OCL 0.53-0.58 i. ArW/OCL 0.14-0.17 d. CaD/OCL 0.43-0.50 d.

**Abdomen:** Tiny, blunt D-L spine sometimes on somite 1 of large specimens, though absent on largest animal and holotype; subsequent somites lacking D-L spines. D spines absent. Somite 2 with 4-5 Li spines on specimens >30 OCL, 1-4 on specimens 20-40 OCL, 0-3 on animals <20 OCL; somites 3-5 of animals >30 OCL and some 20-30 OCL with single Li spine; Li spines small or tiny and moderately pointed or blunt on specimens >30 OCL, blunt or very blunt on smaller animals. Lii spines absent. Dorsal boss absent.

AbdW/OCL 0.49-0.53. OCL/L 0.38-0.43 i.

**Tailfan:** Tailfan spines absent, faint setal bumps along margins of telson and uropods. Standard spines small or very small.

TeL/OCL 0.32-0.39 d.

**Chelae:** Chelae intermediate in shape to very stout, elongate on some very small animals <20 OCL. Teeth well developed on specimens >30 OCL.

**Propodus:** 2 lateral propodal spine rows or 2 to 1 row condition on some specimens <20 OCL; lateral spines small and rather sharp. Lateral spine ridge vague or absent. 6-9 mesal propodal spines. 7-9 dorsal apical spines on normal chelae of specimens >30 OCL, usually 3-5 on specimens 20-30 OCL and 0 or 1 spine on specimens <20 OCL. 5-10 spines above cutting edge of specimens >30 OCL, 1-5 on smaller specimens; spines distributed along full gape of chela, sometimes only 1 proximal spine present on specimens <20 OCL; spines medium-sized to large on specimens >30 OCL, small to medium on lesser animals; spines usually largest proximally. Dorsally, 1-3 medium-sized spines and many smaller spines lateral to dactylar base, or many medium-sized spines; ventrally, 3-5 medium or small spines very close to cutting edge of propodus, spines vague or absent on very small animals. Spines absent proximal to dactylar articulation; precal spines absent.

PropL/OCL 0.76-0.97 i. PropW/PropL (0.38) 0.44-0.51. PropD/PropL 0.27-0.37.

**Dactylus:** 5-9 spines above cutting edge of dactylus of specimens >30 OCL, 1-5 on smaller animals, rarely absent on very small specimens; spines distributed along full gape of chela (sometimes 1 proximal spine on small specimens), spines medium-sized to small with largest spines proximal. Some specimens >30 OCL with 1 or 2 extra dorsal dactylar spines. Mesal dactylar basal spines absent. Apical mesal spines absent except on some regenerate chelae (one specimen with 1 apical dactylar spine on normally proportioned chela, but dactylus also with additional dor-



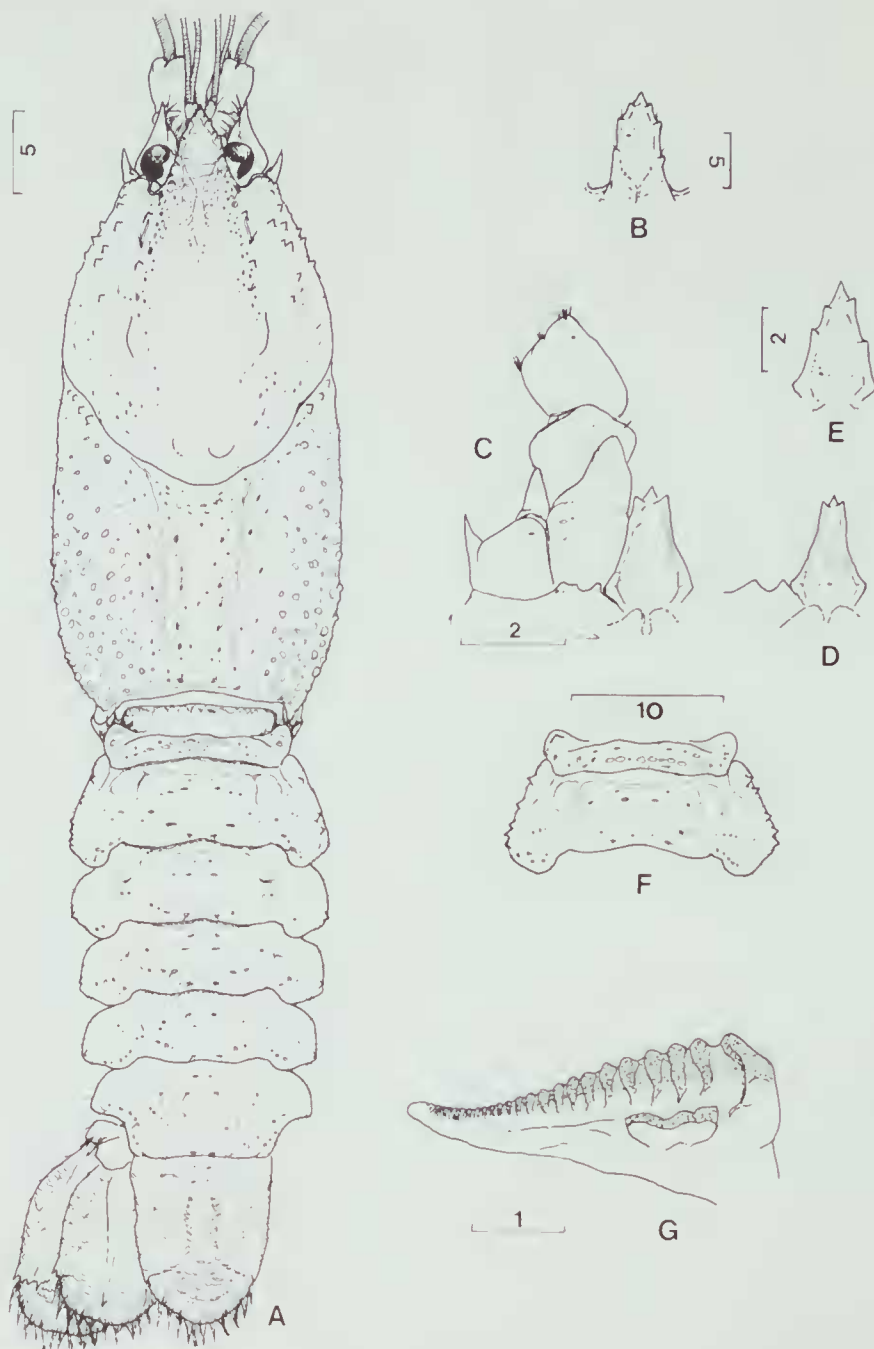


Figure 11. *Euastacus robertsi*. (Holotype not available at time of illustration.) A, dorsal view (paratype ♂, Mt Finigan, QM W5324); B, rostrum: margins nearly parallel (♀, Thornton's Peak, QM W11554); C, ventral view cephalon (paratype ♂); D, more elongate interantennal spine and bifid coxopodite spine (paratype ♂); E, interantennal spine with 2 lateral spines per side (♀, Thornton's Peak); F, abdominal somites 1 and 2; small D-L spine on left side of somite 1, larger Li spines (paratype ♂); G, zygocardiac ossicle (paratype ♂).



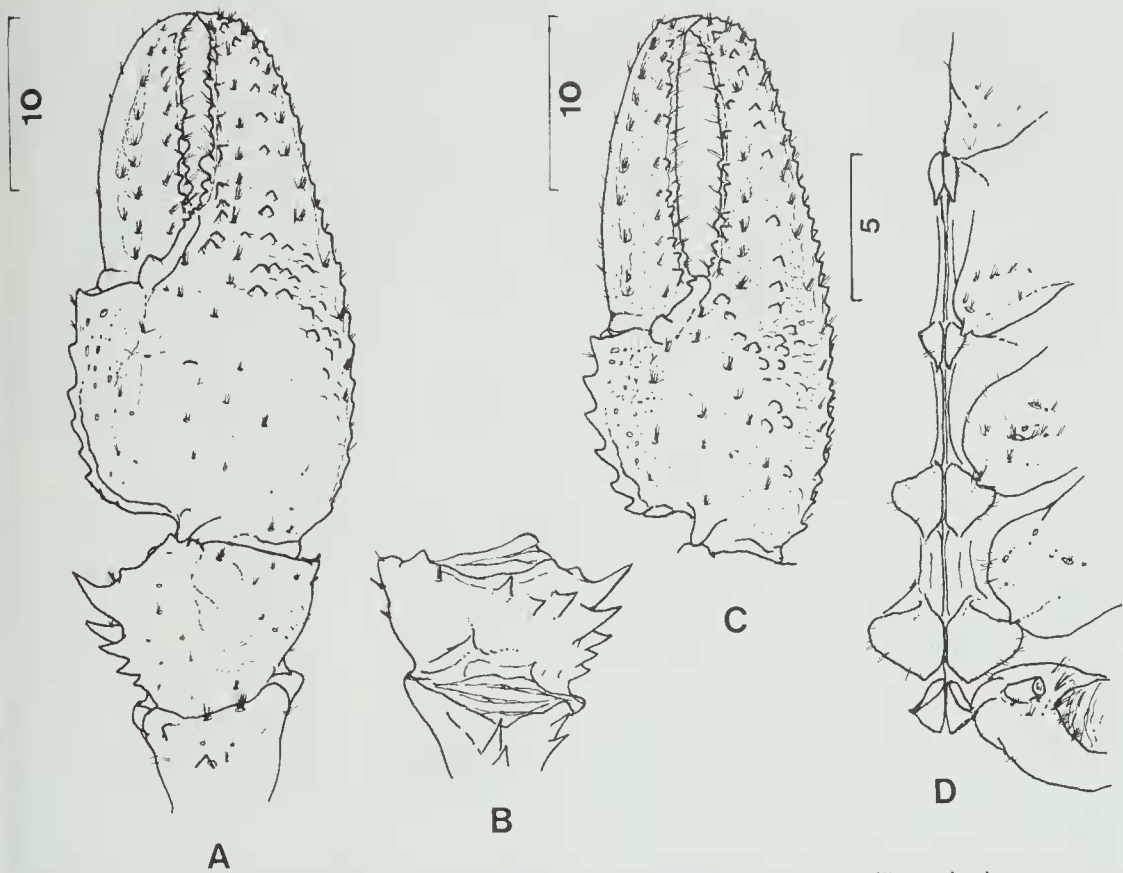


Figure 12. *Euastacus robertsi*. A, dorsal view chela (paratype ♂); B, ventral view carpus illustrating large mesoventral spine (paratype ♂); C, chela: more elongate, apical dactylar spine, (regenerate) (paratype ♂); D, sternal keel (paratype ♂).

sal spine near propodal articulation; both spines atypical of species). Dactylar groove present, deep on some specimens <20 OCL.

DactL/PropL (0.42)0.45-0.58.

Carpus: Dorsolongitudinal groove very shallow (deeper on some regenerate chelae). 4-5 mesal carpal spines; distalmost spine frequently smaller than 2nd, successive spines diminishing in size. Usually 1 or 2 small or tiny lateral carpal spines, sometimes vague. Articulation and dorsal carpal spines absent. Ventral carpal spine small or medium-sized. Several small ventromesal spines (usually 4-6), and mesoventral spine larger than ventral spine.

Merus: 7-12 small dorsal spines. Outer meral spine small or tiny.

Keel: Pr1: Posterior margins very sloped; ventral edges angled down; processes close (or slightly apart) and parallel or closed. Sometimes slight blunt spine on keel after Pr1.

Pr2: Open or very open. Keel after Pr2 usually saddle-shaped.

Pr3: Scoops absent; posterior edges sharp to moder-

ately edged, occasionally rounded. Keel after Pr3 pronounced, often uneven.

Pr4: Scoops absent; posterior edges sharp and straight to convex; anterior edges angular.

Processes 3 and 4 broad or very broad.

Setation: Moderate to light; setae short.

Punctuation: Dense, but rather faint, on cephalon; very dense on thorax.

Gastric mill: TAP count 4.5-5.0; TAA count 1.0; spread 3.0-4.0. Urocardiac ridges 6-7.

Coloration: "Colour in life: Dull blue-purple with a longitudinal red brown mark dorsally on the carapace and the tips of larger spines" (Monroe, 1977).

Sexes: Males possess a cuticle partition. Only the largest female (OCL 50.8) has open gonopores and is berried; female maturity probably occurs at sizes between 30 and 50 OCL.

Distribution and biology. The species is known only from elevations above 1000 m a.s.l. at Mt Finnigan and Thornton Peak, 40 km and 80 km respectively south of Cooktown, north Queensland. Monroe (1977) briefly described aspects of the

habitat at the type locality and though no mention was made of vegetation, it is probably tropical rain-forest. The berried female was collected in September.

*Remarks.* Monroe's (1977) description of *E. robertsi* was detailed but the species is redescribed here to facilitate comparison with other species of *Euastacus* and to document allometric variation in characters.

*Euastacus robertsi* is known only from a small area and little geographic variation is evident. Specimens from Thornton Peak have less triangular rostra and more elongate chelae than those from the type locality.

### *Euastacus sulcatus* Riek

Figures 13, 14

*Astacopsis serratus*. — Watson, 1935: 235 (in part, Mt Tamborine and Lamington National Park as localities).

*Euastacus sulcatus* Riek, 1951: 379. — Riek, 1969: 895.

*Euastacus cunninghami* Riek, 1951: 379–380. — Riek, 1956: 1. — Riek, 1969: 895.

*Material examined.* Holotype. Qld, Binna Burra, Lamington National Park, south-east Queensland, Jan 1943, E.F. Riek, AM P11921, ♂, OCL 78.9 mm.

Allotype. Type locality, AM P11922, ♀, OCL 81.1 mm.

Paratypes. Type locality, 1♂, 1♀; Type locality, AM P13030, 25 specimens; Binna Burra, 1 Dec 1943, E.F. Riek, AM P11924, 1♀; Binna Burra, Jan 1944, E.F. Riek, AM P11923, 1♂, 2♀.

Other specimens. Qld. Bell Bird Ck, near Binna Burra (28°12'S, 153°11'E), 2 May 1981, G.J. Morgan and S.J. Harders, QM W10970, 1♂; Daves Ck Country, Lamington Nat. Park, Mar 1976, QM W7252, 1♀; O'Reillys, Lamington Plateau, 16 Mar 1969, QM W3066, 1♂, 1♀; Best of All Lookout, Springbrook, 26 Dec 1973, QM W5092, 1♀; Creek near Tallanbana Entrance to Warrie Nat. Park, Springbrook, (28°14'S, 153°16'E), 3 May 1981, G.J. Morgan and S.J. Harders, QM W10974, 1♂, 2♀; Above Cameron Falls, Mt Tamborine, 5 Jun 1941, E.F. Riek, AM P11927, 7♂, 7♀; Cameron Falls and Witches Falls, Mt Tamborine, 16 Mar 1942, E.F. Riek, AM P11926, 14♂, 19♀; Cedar Ck, Joalah Nat. Park, Mt Tamborine, 1 May 1981, G.J. Morgan and S.J. Harders, QM W10971, 2 chelae; Upper Currumbin Ck, 1 Oct 1953, E.F. Riek, AM P13054, 1♀; Nerang R. near Nerang, 24 Jan 1973, QM W3835, 1♂; Levers Plateau via Rathdowney, 6 Oct 1973, QM W6462, 1♀; Border Tunnel, Running Ck and Mt Gipps, 14 Apr 1941, E.F. Riek?, AM P11925, 9♂, 7♀, 1♂/♀; Running Ck Falls, Qld-NSW border, near Kyogle, 12 Apr 1941, AM P13462, 2♂; Queen Marys Falls (at base), near Killarney, (28°20'S, 152°24'E), 27 Apr 1981, G.J. Morgan and S.J. Harders, QM W10969, 2♂; Tributary Cronan Ck, Mt Barney, (28°18'S, 152°42'E), 29 Apr 1981, G.J. Morgan and S.J. Harders, QM W10973, 2♂, 3♀; Ball Mt, Mt Superbus,

22–27 Jan 1971, S.R. Montieth, AM P19017, 1♀; Dollys Ck, Emu Vale, 22 Mar 1973, QM W7299, 1♀; Tarome, 12 Oct 1953, E.F. Riek, AM P13046, 1♂, 7♀; Head of Teviot Brook, near Cunninghams Gap, 26 Mar 1980, QM W8608, 1♂; Farm Ck, 6 km east of Mt Colliery, 22 Jun 1974, QM W5452, 1♂; Cunninghams Gap Nat. Park, near picnic area, 8 Jan 1972, QM W5080, 1♂; Western slopes of Cunninghams Gap, 23 Oct 1948, E.F. Riek, AM P11929–P11931, 3♂, 3♀, (types of *E. cunninghami* Riek); Tributary Gap Ck, Cunninghams Gap Nat. Park, (28°04'S, 152°23'E), 25 Apr 1981, G.J. Morgan and S.J. Harders, QM W10967, 3♂, 2♀; Gap Ck near 2nd picnic area, Cunninghams Gap Nat. Park, (28°04'S, 152°22'E), 26 Apr 1981, G.J. Morgan and S.J. Harders, QM W10968, 2♂, 1♀.

NSW. Brindle Ck, near picnic area, north of Kyogle, (28°22'S, 153°03'E), 28 Mar 1981, G.J. Morgan and S.J. Harders, AM P34107, 5♂, 2♀.

*Diagnosis.* Male cuticle partition present. Rostral spine row reaching proximal to midlength or full length of carinae. Rostral base parallel to very divergent, carinae of medium length to long. Antennal squame widest at, or proximal to, midlength. Squamal spines absent. Suborbital spine usually large or very large. Thoracic spines usually absent or just discernible. General tubercles small to medium-sized and dense (>40 OCL). 2–6 large or medium-sized Li spines on abdominal somite 2. D spine absent or small. Abdominal boss present (accented by colour). Telsonic surface spines absent or small. Marginal spines on uropods absent. Lateral propodal spines in 2 to 1 row condition (sometimes almost 2 rows). 3–11 dorsal apical propodal spines. Spines above propodal and dactylar cutting edges apical (row rarely extending to midlength of gape). Usually 5 mesal propodal spines. 1–4 dorsal mesal dactylar basal spines. 0–2 marginal mesal dactylar basal spines. 2–5 apical mesal dactylar spines. Dorsolongitudinal groove of carpus deep. 2–3 mesal carpal spines. Ventromesal carpal spines smaller than ventral spine. Keel Pr1 usually abrupt or semi-abrupt, and usually apart. TAP count 3.5–5.0.

*Description.* Maximum OCL 81.1 mm.

*Rostrum:* Rostrum reaching base or midlength of 3rd antennal segment on specimens >40 OCL, distal to midlength on some specimens 20–40 OCL, to end of segment on some specimens <20 OCL. Rostral sides parallel or slightly convergent on specimens from Lamington Plateau; in peripheral areas (Cunninghams Gap, northern New South Wales, Springbrook), sides often distinctly convergent. Rostral base parallel to very divergent. Carinae of medium length to long. Marginal spines numbering 3 (very rarely 2) to 5 per side, row reaching proximal to midlength or to full carinae length; spines medium-sized on specimens >60 OCL, generally larger on smaller specimens; spines moderately pointed to sharp (rounded

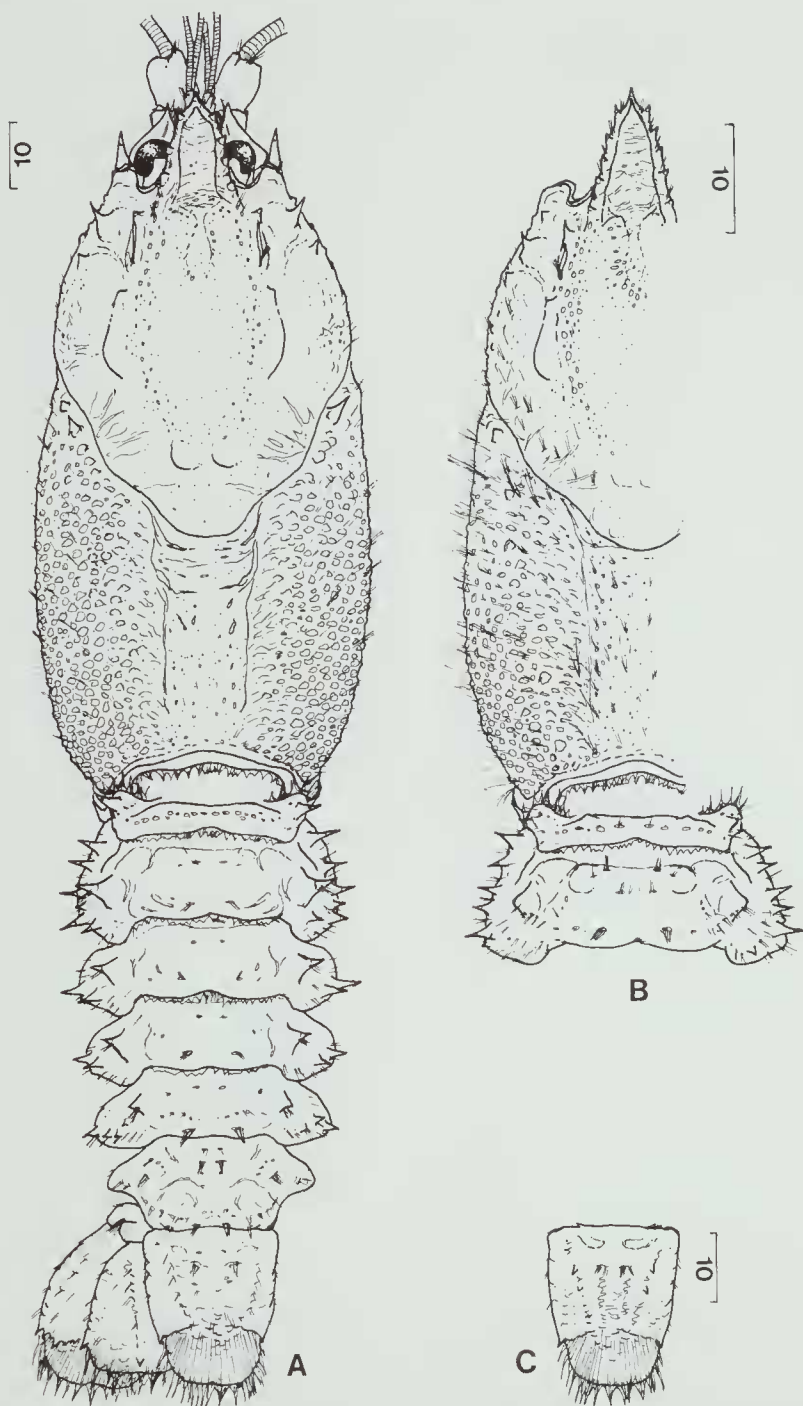


Figure 13. *Euastacus sulcatus*. A, dorsal view (holotype ♂, Binna Burra, AM P11921); B, dorsal view: larger rostral spines, smaller abdominal D-L spines, larger D spines including small spine on somite 1 (rare), more setose, wider abdomen (sexual) (♀, Cunninghams Gap, AM P11929, holotype for *E. cunninghami*); C, telson: small telsonic spines (♂, Brindle Ck, AM P34107).



Figure 14. *Euastacus sulcatus*. A, dorsal view chela (holotype ♂); B, dorsal view chela: less angular, fewer apical spines on propodus and dactylus (allometry), no spine lateral to dactylar base, 3 mesal carpal spines (rare) (♀, Cunninghams Gap, AM P11931, paratype of *E. cunninghami*); C, dactylus and mesal propodus: 2 dorsal mesal dactylar basal spines, spines above cutting edge more spaced, 6 mesal propodal spines, extra dorsal apical dactylar spine absent (allometry) (♂, Mt Barney, QM W10973); D, zygocardiac ossicle (secondary ridge near ear rare) (paratype ♀, Binna Burra, AM P13030, Francois collection); E, ventral view cephalon (holotype ♂); F, ventral view cephalon: single cusp on coxopodite spine, larger basipodite spine, broader interantennal spine (♀, Cunninghams Gap); G, sternal keel (holotype ♂); H, keel processes 3 and 4 (♂, Brindle Ck).



on one medium-sized specimen, probably due to wear). Acumen spine similar to, or slightly larger than, marginal spines on specimens >40 OCL, much larger on some smaller crayfish.

OCL/CL 0.71-0.89 i. RW/OCL 0.14-0.25 d.

**Cephalon:** Cephalon spiny to poorly spinose, spination poor on most small specimens. Usually 1-3 large spines and smaller spines and bumps ventral to postorbital ridge. 1st postorbital spine usually medium-sized to large, rarely small. 2nd postorbital spine small edge to small on specimens >40 OCL, often medium or large on smaller animals. Suborbital spine usually large or very large, occasionally medium-sized. Lateral margin of squame slightly convex to slightly concave; squame widest at midlength or proximal to midlength on specimens >40 OCL, always proximal to midlength on smaller animals; marginal spines absent. Interantennal spine of medium width to broad on specimens >40 OCL, very broad on some smaller animals; spine margins distinctly scalloped or slightly to distinctly toothed. Antennal basipodite spine absent or small on specimens >60 OCL, absent to large on smaller specimens (very large on some <20 OCL); coxopodite spine small to medium-sized and unimodal, bifid or serrated.

ScL/OCL 0.12-0.35 d.

**Thorax:** Thoracic spines usually absent or just discernible; sometimes 1-3 small or medium-sized, blunt to moderately sharp spines behind cervical spines. General tubercles small to medium-sized on specimens >20 OCL, very small or absent on smaller animals; tubercles dense or very dense on specimens >40 OCL, sparse to dense on specimens 20-40 OCL and sparse to absent on animals <20 OCL. Usually 1-4 cervical spines per side, sometimes absent especially on smaller specimens; spines medium-sized or small and moderately pointed or blunt, dorsal spine frequently larger and sharper than others.

ArL/OCL 0.36-0.43. CaW/OCL 0.52-0.62. ArW/OCL 0.13-0.23 d. CaD/OCL 0.46-0.61 d.

**Abdomen:** D-L spine present or absent on somite 1 (specimens <20 OCL always lacking spine); spine large to tiny, smallest on small animals, and very sharp to blunt. D spine usually absent on somite 1, small or tiny and blunt when present. Somite 2 with 2-6 (usually 4 or 5) Li spines per side on most specimens >20 OCL; Li spines absent on most smaller animals. 1 Li spine on somites 3-5 of specimens >40 OCL and most 20-40 OCL. Li spines decreasing posteriorly from large to medium-sized or small on large specimens and medium-sized or small to tiny on small animals; spines sharp or very sharp on specimens >40 OCL, very sharp to blunt on smaller animals. Lii spines usually absent on somite 2, though 1-3 spines sometimes present. Somites 3-5 usually with 1-3 Lii spines, sometimes absent especially on small crayfish. Somite 6 with 0-2 Lii spines. Lii spines large to tiny, generally largest on somite 3 or 4, and decreasing to posterior; spines on specimens 20-40 OCL small or tiny. Lii spines very sharp to blunt. Usually D-L spine on somites 2-5 of specimens >20 OCL and frequently on somite 6 of large specimens; D-L spine large to tiny, decreasing to posterior, and very sharp to blunt. D spine poorly developed, sometimes on somites 2-3 (rarely 4) of specimens >40 OCL,

spine small or tiny and usually blunt or very blunt (rarely moderately pointed). D spine usually absent on specimens from Lamington and northern N.S.W., better developed in western areas of species' range. Specimens <20 OCL usually lacking abdominal spines. Abdominal dorsal boss present on specimens >40 OCL and on some smaller specimens; boss not very pronounced, though often accented by cream or white coloration.

AbdW/OCL  $\sigma$  0.45-0.57,  $\varphi$  0.45-0.64 i. OCL/L  $\sigma$  0.32-0.45 i,  $\varphi$  0.34-0.41 i.

**Tailfan:** Telsonic spines usually absent on specimens in Lamington area, more common in western areas and northern N.S.W. When present, spines tiny to small (rarely medium-sized) and numbering 1-5; specimens <40 OCL usually lacking telsonic spines. Lateral telsonic spines and uropod spines absent, though setal bumps developed. Standard spines usually small to medium-sized, large on some specimens <40 OCL.

TeL/OCL  $\sigma$  0.30-0.45 d,  $\varphi$  0.36-0.46.

**Chelae:** Chelae intermediate to elongate in shape on specimens >20 OCL, very elongate on some smaller animals. Teeth well developed on most specimens >40 OCL.

**Propodus:** Lateral propodal spines in 2 to 1 row condition, sometimes almost 2 rows; some regenerate chelae with 2 rows and some specimens <20 OCL with single lateral row. Lateral spines medium-sized or large and sharp. Outer spine ridge vague to obvious. Mesal propodal spines usually numbering 5, sometimes 4 or 6; some regenerate chelae with 7 spines. 3-11 dorsal apical propodal spines on specimens >60 OCL, 2-8 on specimens 40-60 OCL, 0-8 on animals 20-40 OCL, 0 on specimens <20 OCL. On large specimens, dorsal apical spine row often reaching proximal of dactylar base. 2-5 spines above cutting edge of specimens >60 OCL, 0-3 on smaller specimens; spines apical (row rarely extending to midlength of gape) and large to medium-sized on large animals, medium to small on small individuals; specimens <20 OCL lacking spines above cutting edge. Usually 1 medium to very large spine lateral to dactylar base dorsally, sometimes 2-3 spines or spines absent; spines often joining apical propodal spines. Usually some low bumps on outer spine ridge. Ventrally, 4-10 spines lateral to dactylar base, in row reaching distally along propodus on specimens >40 OCL from the Lamington area and northern N.S.W.; similarly sized animals from western areas (eg. Cunningham's Gap) usually with fewer spines (1-7); animals 20-40 OCL with 1-8 spines, most numerous on specimens in the Lamington area. Specimens <20 OCL sometimes lacking spines. Frequently 1 or 2 ventral apical propodal spines. Sometimes small spine posterior to dactylus, frequently only low ridge or bumps. Precarpal spines usually absent (some regenerate chelae with 1-2 small bumps).

PropL/OCL  $\sigma$  0.78-1.02 i,  $\varphi$  0.82-0.98. PropW/PropL 0.30-0.46 id. PropD/PropL 0.22-0.31.

**Dactylus:** 2 (rarely 1)-4 apical spines above dactylar cutting edge on chelae of specimens >40 OCL, 0-3 spines on specimens 20-40 OCL, smaller specimens lacking spines; spines small to large. 1-5 extra dorsal dactylar spines on most specimens >40 OCL; regenerate chelae and specimens <40 OCL usually lacking extra dorsal

spines. 1-3 (rarely 4) dorsal mesal dactylar basal spines, 0 on some regenerate chelae and specimens <20 OCL. 0-1 (rarely 2) marginal mesal dactylar basal spines, more frequently on specimens from areas peripheral to Lamington. Basal spines medium-sized to very large, usually rather sharp. 2-5 (usually 4) apical mesal dactylar spines. (Apical and basal mesal spines sometimes forming irregular row.) Dactylar groove shallow or distinct, deep on small specimens.

Dactl./Propl. 0.47-0.59(0.60).

Carpus: Dorsolongitudinal groove deep. Usually 2 or 2( + 1) mesal carpal spines, occasionally 3 distinct spines. Distalmost spine largest and usually slightly more ventral than 2nd; 2nd and 3rd spines frequently contiguous at their bases. Lateral carpal spines medium-sized to large on specimens >40 OCL, small on some lesser individuals. Articulation spine usually absent on specimens >40 OCL, tiny to large on some smaller animals. Dorsal carpal spines absent except on some regenerate chelae. Ventral carpal spine large or very large (small on some very small animals). Largest ventromesal spine medium-sized to small with 1-3 smaller spines.

Merus: 7-12 dorsal meral spines. Outer meral spine medium-sized (rarely small) to large.

Keel: Pr1: Posterior margins usually abrupt to semi-abrupt (occasionally sloped). Ventral profiles slightly angled back, rounded, flat or angled down. Processes slightly to distinctly apart (close on one large specimen), usually parallel or closed in orientation. Keel after Pr1 occasionally with low, blunt spine.

Pr2: Usually open; if almost parallel, processes distinctly apart. Keel after Pr2 usually anteriorly pronounced, sometimes slightly saddle-shaped.

Pr3: Scoops absent or slight, bases sharp to rounded. Keel after Pr3 usually saddle-shaped in Lamington area, posteriorly pronounced near Cunninghams Gap. Intermediate shapes common. Keel very pronounced on most specimens <40 OCL.

Pr4: Usually lacking or with only slight scoops, sharp to moderately rounded; anterior edges angular to very angular. Posterior profile usually irregular, sometimes straight or slightly convex.

Processes 3 and 4 narrow or just broad on specimens >40 OCL, often distinctly broad on smaller animals.

Setation: Light to rather heavy in east, western specimens more heavily setose.

Punctuation: Dense or very dense, pores often faint on cephalon.

Gastric mill: IAP count 3.5-5.0; TAA count 1.0-1.5; spread 2.5-3.5 (rarely 4.0). Urocardiac ridges 7-11, increasing with specimen size.

Coloration: Body bright blue or blue/green dorsally on Lamington Plateau (L.P.) specimens, deep red in New South Wales, dark red/brown in west. Carapace paler ventrolaterally (often almost white on L.P.). Pale patches on dorsal cephalon. General tubercles and cephalic spines pale, often white. Rostral carinae pale. Abdominal dorsal boss often pale on large specimens, frequently white. Abdominal spines white. Carpus of cheliped blue on L.P., red in N.S.W., blue/green or green/brown in west; distal and lateral carpal edges often white; mesal spines blue

or white. Propodus white laterally, often with dark mottling, grading to dark blue mesally on L.P.; red with white mottling in N.S.W.; blue/green or brown in west. Dactylus white with base blue on L.P.; base red in N.S.W.; base green in west. Fingers white or cream.

Body blue and white ventrally on L.P., orange and white in N.S.W., red and orange in west. Carpus of cheliped dark blue mesally and white laterally (or blue with lateral white patch) on L.P.; red in N.S.W.; blue/green mesally and orange laterally in west. Propodus primarily white with mesal blue area on L.P., white with red mesally in N.S.W., orange with green mesal edge in west. Lateral spines white. Fingers pale or white.

Colours of western crayfish often obscured by algae and debris attached to setae. Distinct blues and reds of adult crayfish (L.P., N.S.W.) poorly developed on specimens <30 OCL.

Sexes: Males possess a wide cuticle partition. A small male (OCL 26.8 mm) from Queen Marys Falls extruded spermatophores suggesting male sexual maturity at a small size.

Two of the females examined are mature near the upper limits of the 20-40 OCL range (OCLs of 38.9 and 39.3 mm) and the latter is berried. This is rather a small maturation size for females of a relatively large species. However, the majority of females <40 OCL have unopen gonopores. Nine of 12 females 40-60 OCL and all females >60 OCL appear mature. It seems that female maturation usually occurs at OCLs of 40-60 mm.

*Distribution and biology.* The species inhabits mountains forming a crescent from Mt Tamborine to the Lamington Plateau in southern Queensland, west along the McPherson Range bordering New South Wales and north via Cunninghams Gap into the Mistake Mountains. Major drainage systems include the Nerang, Albert, Logan and possibly the Brisbane, Rivers flowing north and east, the Condamine River flowing west and the Richmond River in New South Wales. A relic population of *E. sulcatus* may persist on Mt Warning, drained by the Tweed River. *Euastacus sulcatus* appears restricted to streams bordered by rainforest or occasionally wet sclerophyll at altitudes exceeding 300 m a.s.l., rarely at lower elevations. The Nerang specimen was probably washed downstream during the seasonal heavy rains. Much of the natural vegetation has been cleared in the species' range and large stands of highland rainforest remain only in state forests and national parks. Females bear eggs over winter, with hatching probably in spring and summer. *Euastacus sulcatus* frequently has been observed walking overland from streams. A species of *Cherax* occurs in creeks at lower altitudes, the boundary between the two genera often closely correlating with the dry sclerophyll-rainforest ecotone.

*Remarks.* *Euastacus cunninghami* was described by Riek (1951) on the basis of specimens from only



the type locality of Cunninghams Gap. The species is here synonymised with *E. sulcatus* on the basis of morphologically intermediate populations from sites along the "Scenic Rim" of mountains partitioning Queensland and New South Wales. Even populations from the respective type localities are not distinguishable by Riek's diagnostic characters of setation, thoracic ornamentation and abdominal spination. Many of the apparent differences were probably due to comparison of animals of different sizes.

*Euastacus sulcatus* is a variable species. Frequently the carinae bases of southern forms are more nearly parallel than are those of specimens in the east. D abdominal spines are always small or absent, but usually better developed in the west. Telsonic spines are better developed in the western area than in the east, though spines are small or tiny when present. Dorsal apical propodal spines and ventral spines lateral to the dactylar base are more numerous in the eastern areas, though this is partly due to size effects. Marginal mesal dactylar basal spines are more common in western forms. The shapes of keel processes 3 and 4 vary considerably across the species' range, as does the profile of the keel between these processes. Setation is generally heavier in the west. Gastric mill TAP counts are usually higher in the east, due to longer zygocardiac ears.

The major variation within *E. sulcatus* is that of colour forms. Western populations are overall green/brown; the northern New South Wales population of Brindle Ck is distinctly red, while the Lamington and Springbrook populations are bright blue or blue/green. There is some variation from these three basic colour forms, but the colour patterns are very similar throughout the range of the species. In particular, the paler and white areas are similar in all populations.

It appears that the blue Lamington Plateau crayfish attain a greater size than those elsewhere. No specimens > 60 OCL have been collected from western areas but sampling has not been intensive. The apparently larger sizes of eastern crayfish may be due in part to greater exposure of these animals to human observation and collecting.

#### *Euastacus suttoni* Clark

Figures 15, 16

*Astacopsis serratus*.—McCulloch, 1917: 237-238 (in part, Lyra near Stanthorpe, Qld, as locality).

*Euastacus nobilis*.—Clark, 1936: 15-17 (in part, Stanthorpe, Qld, as locality).

*Euastacus suttoni* Clark, 1941: 18-19, pl.5.—Clark and Burnet, 1942: 90-91.—Riek, 1951: 381.—Riek, 1969: 895.

*Material examined*. Holotype. Qld, Wyberba(h), south Queensland, E. Sutton, NMV J877, ♀, OCL 86.3 mm.

Other specimens. Qld, Bald Rock Ck, Wyberba, 19 Nov 1952, QM W1835, 1 ♀; Girraween Nat. Park, south-east Queensland, Feb 1967, QM W5093, 1 ♀; Girraween Nat. Park, in creek in caves, 7 Dec 1971, QM W5081, 1 ♀; Glenalpin, 8 miles from Stanthorpe, tributary of Severn R., 1936, AM P11920, 1 ♀; Lyra, May 1912, W. Gawith, AM P3075-P3077, P3084, 3 ♂, 3 ♀.

NSW. Bald Rock Ck, Bald Rock Nat. Park, (28°51'S, 152°02'E), 31 Mar 1981, G.J. Morgan and S.J. Harders, AM P33888, 2 ♂, 3 ♀; Washpool Ck, near Thunderbolts Hideout, north of Tenterfield, (28°58'S, 152°04'E), 1 Apr 1981, G.J. Morgan and S.J. Harders, AM P33906, 3 ♂; Bluff R., New England Highway near Bluff Rock, (29°12'S, 152°01'E), 2 Apr 1981, G.J. Morgan and S.J. Harders, AM P33904, 4 ♂; Poverty Point, 3000 ft, 15 miles south-east of Tenterfield, Dec 1973, QM W6463, 1 ♂, 2 ♀; Scrubby Gully, headwaters of Highland Home Ck, 4 miles north-north-west of Torrington, New England District, AM P15535, 1 ♀; Deepwater R., 10 km upstream of New England Highway, Mar 1981, D. Dye, 1 ♂, 1 ♀; Deepwater R., near Ten Mile, east of Deepwater, (29°30'S, 152°04'E), 12 Apr 1981, G.J. Morgan and S.J. Harders, AM P33903, 4 ♂, 2 ♀; Severn R., near Dundee, north of Glen Innes, 1922, AM P5673, 1 ♂; Gibraltar Range Nat. Park, 9 Dec 1972, QM W6468, 1 ♀; Boundary Ck, Gibraltar Range Nat. Park, (29°33'S, 152°16'E), 2 Apr 1981, G.J. Morgan and S.J. Harders, AM P33907, 1 ♂; Dandahra Ck at junction with Waratah Ck, Gibraltar Range Nat. Park, (29°32'S, 152°19'E), 3 Apr 1981, G.J. Morgan and S.J. Harders, AM P33887, 1 ♂, 1 ♀; Swamp near Waratah Trig sign beside Gwydir Highway, Gibraltar Range Nat. Park, (29°30'S, 152°19'E), 3 Apr 1981, G.J. Morgan and S.J. Harders, AM P33890, 1 ♂, 2 ♀; Coombadja Ck, below Waratah Trig, Gibraltar Range Nat. Park, (29°30'S, 152°18'E), 3 Apr 1981, G.J. Morgan and S.J. Harders, AM P33905, 2 ♂, 3 ♀.

*Diagnosis*. Male cuticle partition present. Row of rostral marginal spines usually not reaching mid-length of carinae. Rostral base slightly to very divergent, carinae of medium length to long. Antennal squame widest at or slightly proximal to mid-length (> 40 OCL). Squamal spines absent. Suborbital spine medium-sized to large. Thoracic spines medium-sized to large (> 60 OCL). General tubercles medium-sized or large, moderate to sparse in density. 3-6 medium-sized or large Li spines on abdominal somite 2 (> 40 OCL). Medium-sized or small D spine usually present on somites 2-5 (> 40 OCL), sometimes several on somite 6. Abdominal boss present but not obvious. 4-12 medium-sized to tiny telsonic surface spines (> 40 OCL). Outer ramus of uropod lacking marginal spines. Lateral propodal spines in 2 to 1 row condition. Usually 1 dorsal apical propodal spine (variable). Spine rows above propodal and dactylar cutting edges not reaching midlength of gape. 5 (rarely 6) mesal

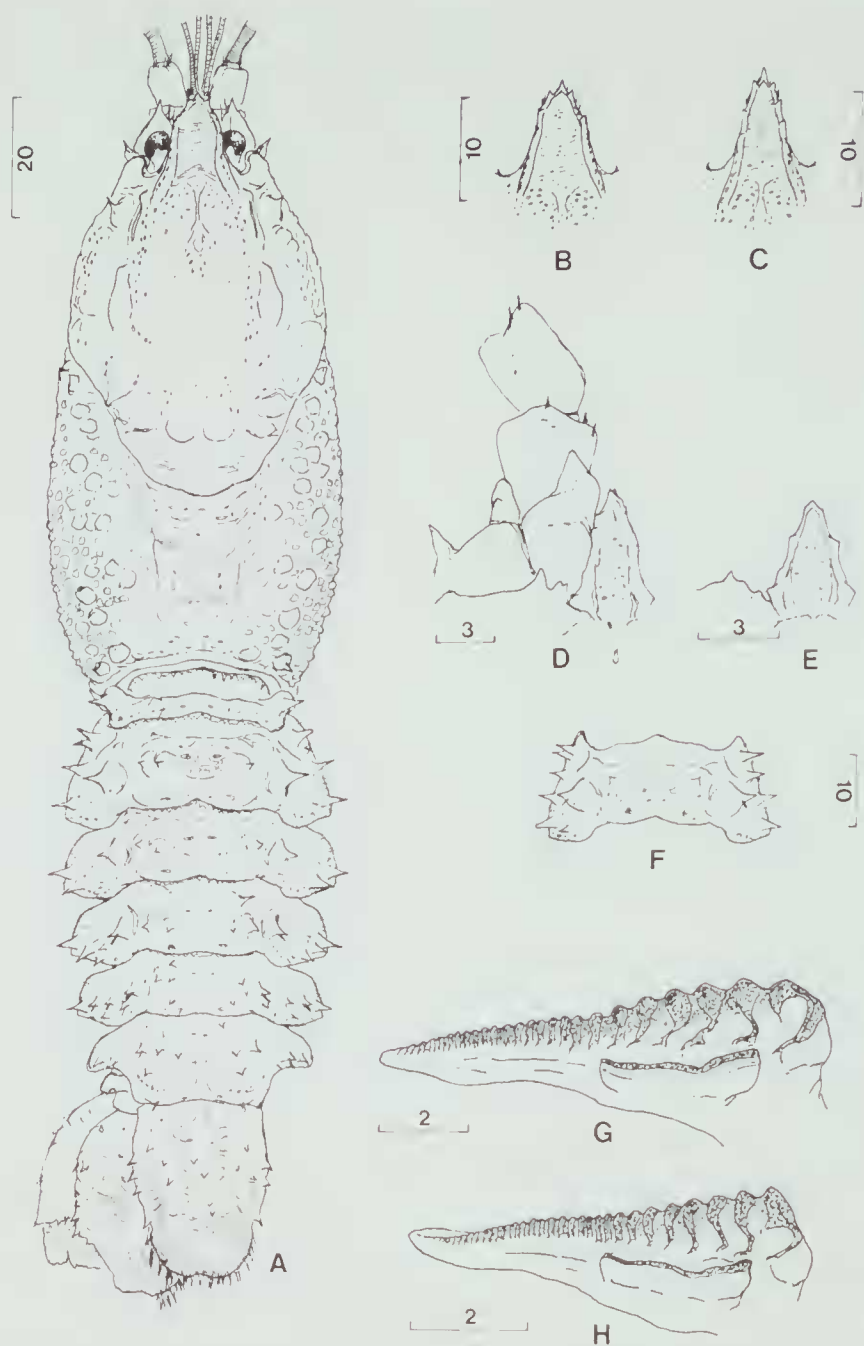


Figure 15. *Euastacus suttoni*. A, dorsal view (holotype ♀, Wyberba, NMV J877); B, rostrum (♀, Gibraltar Range, AM P33890); C, rostrum: more elongate (♀, Deepwater R., AM P34082); D, ventral view cephalon (holotype ♀); E, interantennal spine and coxopodite spines (♀, Deepwater R.); F, abdominal somite 2: more numerous Li spines, single D spine per side, narrower (sexual) (♂, Gibraltar Range, AM P33890); G, zygocardiac ossicle (holotype ♀, Francois collection); H, zygocardiac ossicle: teeth closer (♂, Coombadja Ck, AM P33905).



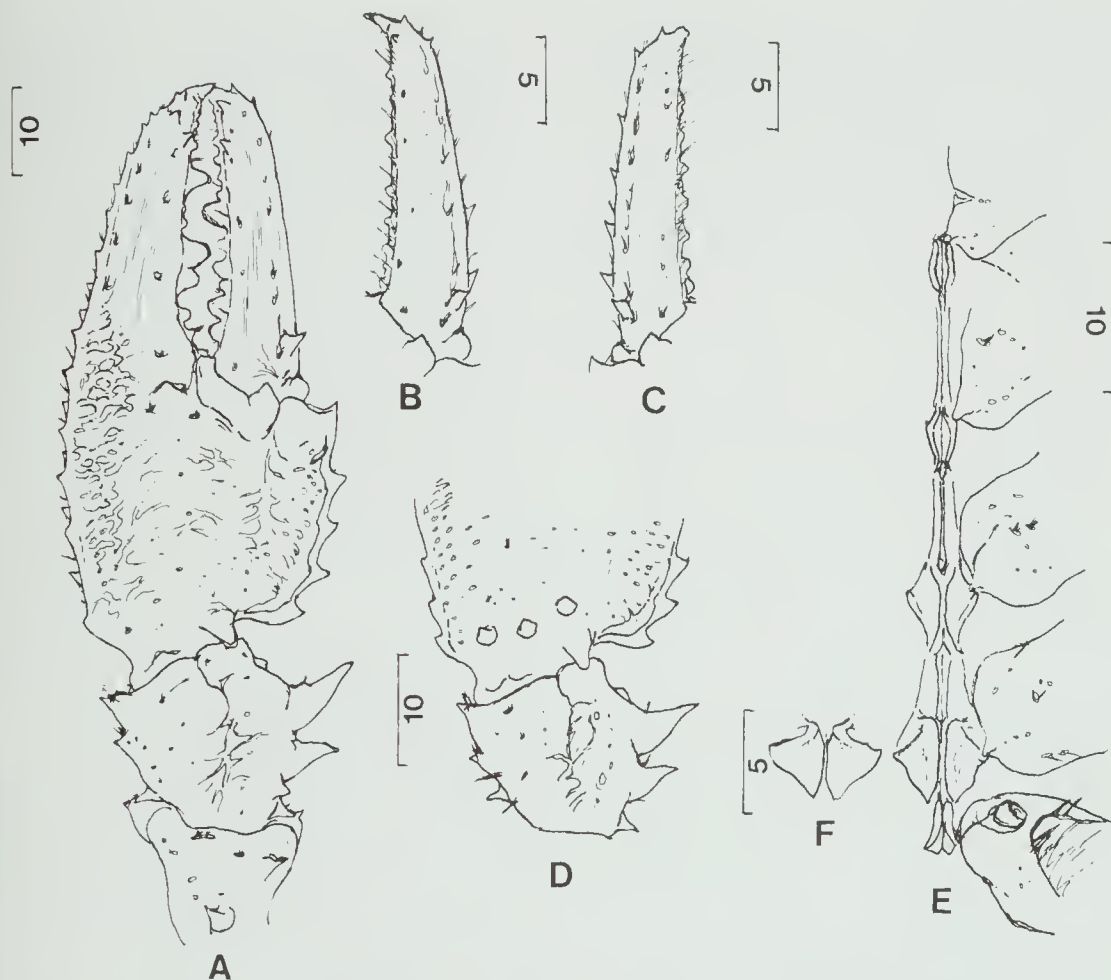


Figure 16. *Euastacus suttoni*. A, dorsal view chela (holotype ♀); B, dorsal view dactylus: 2 marginal mesal basal spines (♀, Deepwater R.); C, dactylus: row of marginal spines (regenerate) (♂, Deepwater R., AM P34082); D, carpus and proximal propodus: precarpal spines present, 3rd mesal carpal spine absent (♀, Gibraltar Range); E, sternal keel (♂, Gibraltar Range); F, keel Pr4: broader (allometry) (♀, Deepwater R.).

propodal spines. 1 dorsal mesal dactylar basal spine. 0-3 marginal mesal dactylar basal spines. 2-3 (rarely 4) apical mesal dactylar spines. Dorsolongitudinal groove of carpus deep. 2 (rarely 3) mesal carpal spines. Largest ventromesal carpal spine smaller than ventral spine. Keel Pr1 usually semi-abrupt and apart to close. TAP count 5.5-9.5.

**Description.** Maximum OCL 86.3 mm.

**Rostrum:** Rostrum reaching midlength of 3rd antennal segment on specimens >40 OCL, sometimes distal to midlength of segment on small crayfish. Rostral sides parallel to convergent, usually slightly convergent; base usually slightly to very divergent, sometimes parallel on small specimens. Carinae of medium length to long, not spread. 1-4 marginal spines per side (most commonly 2-

3), row usually not reaching midlength of carinae, occasionally distal to midlength on specimens <20 OCL. Spines small to medium-sized and moderately pointed to rounded on specimens >40 OCL, approaching large and sharp on smaller crayfish, particularly those from southern areas. Acumen spine similar to, or slightly larger than, marginal spines on specimens >40 OCL, often much larger on smaller animals.

OCL/CL 0.76-0.88 i. RW/OCL 0.14-0.26 d.

**Cephalon:** Spination moderate to weak, with 1-3 sharp spines and smaller bumps below postorbital ridges. 1st postorbital spine an edge on specimens >60 OCL, usually medium-sized or large on smaller animals. 2nd postorbital spine a small edge to small on crayfish >20 OCL, medium-sized or large on some very small specimens. Suborbital spine medium-sized to large, usually slightly

curved inwards. Lateral margin of squame convex to straight; squame widest at or slightly proximal to midlength on specimens  $>40$  OCL, very proximal on specimens  $<20$  OCL; marginal spines absent (one specimen with spine on one squame only). Interantennal spine elongate on specimens  $>60$  OCL, broader on smaller crayfish and sometimes very broad on animals  $<20$  OCL; margin scalloped or slightly toothed (usually 2 small spines near apex). Antennal hasipodite spine absent or small on specimens  $>40$  OCL, often medium-sized or large on smaller specimens. Coxopodite spine usually medium to small, large on some animals  $<40$  OCL, usually bifid or serrated.

Scl/OCL 0.12-0.31 d.

**Thorax:** Approximately 6-11 dorsal spines per side, distributed in zone or row on specimens  $>40$  OCL; smaller specimens often with fewer spines. Crayfish  $<20$  OCL usually lacking dorsal spines. Spines large to medium-sized on specimens  $>60$  OCL, smaller on lesser crayfish; spines blunt to very sharp (not correlating closely with crayfish size). General tubercles large to medium-sized on specimens  $>60$  OCL, smaller on smaller animals, crayfish  $<20$  OCL often lacking general tubercles; density usually moderate to sparse. 1-3 cervical spines per side; spines small to large and blunt to sharp (dorsalmost spine usually larger and sharper than others).

ArL/OCL 0.33-0.38, CaW/OCL 0.55-0.62, ArW/OCL 0.13-0.21 d. CaD/OCL 0.49-0.56 d.

**Abdomen:** Somite 1 with moderate to sharp D-L spine on specimens  $>60$  OCL and many smaller specimens, absent on animals  $<20$  OCL. Rarely D spine on somite 1. Somite 2 with 3-6 Li spines per side on specimens  $>40$  OCL, 0-4 on smaller crayfish; 1 Li spine on somites 3-5, except on some small animals; 1 i spines large to medium-sized and sharp to moderately pointed on crayfish  $>40$  OCL, smaller and blunter on smaller crayfish. 1 ii spines well developed on somites 3-6, numbering 1-4 per side, higher numbers most commonly on somite 5 of large specimens; 1 ii spines large to small on specimens  $>40$  OCL, tiny or absent on smaller specimens; spines very sharp on large specimens, blunter on small animals. 1 D-L spine usually on somites 2-3; sometimes 2 D-L spines per side on somites 4-6, particularly on specimens  $>60$  OCL. D-L spines large to very small, very sharp to moderately pointed, often tiny and very blunt on specimens  $<40$  OCL. D spines usually present on somites 2-5 of crayfish  $>40$  OCL; D spines usually single but sometimes 4 per side on somite 5 of large crayfish. D spines poorly developed on somite 6, absent on specimens  $<60$  OCL; D spines medium-sized to small on large crayfish, tiny on small specimens and very sharp to very blunt. Somite 6 rather spiny on large specimens, usually with several small D and D-L spines. Spinal development poor on crayfish  $<40$  OCL, specimens  $<20$  OCL usually lacking abdominal spines. Specimens from Deepwater with better development of D-L and D spines than similarly sized crayfish elsewhere. Low dorsal boss on very large specimens, very vague or absent on crayfish  $<80$  OCL.

AbdW/OCL  $\sigma$  0.48-0.56 d,  $\varnothing$  0.51-0.65 i. OCL/L 0.34-0.44 i.

**Tailfan:** Medium-sized to tiny surface spines on telson of specimens  $>40$  OCL, often absent on smaller animals and never present on animals  $<20$  OCL. Telsonic spines numbering 4-12, usually most numerous on large crayfish. Southern specimens (eg. from Gibraltar Range) usually with more spinose telsons than northern crayfish. Telson usually with 1-3 marginal spines per side, absent on most specimens  $<40$  OCL. Inner ramus of uropod sometimes with 1-2 small to tiny surface spines (often absent). Usually 3-6 marginal spines on inner ramus of specimens  $>40$  OCL, vague or absent below this size. Outer ramus lacking marginal spines, some bumps present. Standard spines small to medium-sized on crayfish  $>40$  OCL, larger below this size.

TeL/OCL  $\sigma$  0.31-0.46 d,  $\varnothing$  0.34-0.43 di.

**Chelae:** Chelae intermediate to elongate in shape, very elongate when regenerate or on specimens  $<20$  OCL. Teeth well developed on crayfish  $>60$  OCL.

**Propodus:** Lateral spines in 2 to 1 row condition, ventral row usually well developed but sometimes absent on very small crayfish and regenerate chelae. Lateral spines medium-sized or small, usually sharp. Usually 5 mesal propodal spines, sometimes 6 (3-6 spines on regenerate chelae, 4 on some very small crayfish). Usually 1 apical spine on crayfish  $>60$  OCL, less evident or absent below this size (most Gibraltar Range specimens lacking apical spine, regardless of size). 1-3 spines above cutting edge of specimens  $>40$  OCL, fewer or absent on smaller crayfish; spine row not reaching midlength of gape of chela, spines usually small (occasionally medium-sized). Dorsally, usually 1 medium-sized to large spine and low outer bumps lateral to dactylar base, spine occasionally absent especially on crayfish  $<20$  OCL. Ventrally, 1-4 spines lateral to dactylar base; spines medium-sized on specimens  $>40$  OCL, usually smaller on lesser specimens; spines often distributed some distance along finger. Sometimes low ridge or bumps proximal to dactylar base; often 1-3 precarpal spines, best developed on southern crayfish.

PropL/OCL (0.70) 0.74-0.91 i. PropW:PropL 0.39-0.49 id. PropD:PropL 0.25-0.31.

**Dactylus:** Usually 1-2 spines above cutting edge of specimens  $>40$  OCL (up to 4 spines on regenerate chelae); spine row not reaching midlength of gape (one aberrant specimen with 3 spines along full gape of one chela); spines small to medium-sized. Crayfish  $<40$  OCL often lacking spines above cutting edge. No extra dorsal spines. 1 dorsal mesal basal spine (absent on some regenerate chelae). 0-3 marginal mesal basal spines, southern specimens often with more numerous marginal basal spines than those from Queensland. Basal spines large to medium sized, usually sharp. 2-3 (rarely 4) apical dactylar spines. Dactylar groove shallow, or deep on some small crayfish.

DactL:PropL 0.51-0.60.

**Carpus:** Dorsolongitudinal groove deep. Usually 2 mesal carpal spines, sometimes 2(+1) (one large specimen with 3 on both carpi); distalmost spine largest and only slightly offset ventrally to 2nd. 2 large to medium (occasionally small) lateral carpal spines. Small articulation spine on specimens  $<60$  OCL. 1-3 dorsal carpal spines on some specimens (usually absent). Ventral car-

pal spine very large to medium-sized. 1-3 ventromesal spines, largest medium-sized or small, always smaller than ventral spine.

**Merus:** 6-9 dorsal meral spines (occasionally more on regenerate chelae, fewer on some very small specimens). Outer meral spine absent or small to medium-sized on specimens >40 OCL, sometimes large on smaller crayfish.

**Keel:** Pr1: Posterior margins sloped on one large crayfish, usually semi-abrupt, abrupt on some specimens. Ventral profile angled, rounded or flat; processes close, slightly apart or apart; orientation usually parallel, sometimes closed. Keel after Pr1 sometimes with low bump or spine.

Pr2: Orientation almost parallel to open; processes projecting steeply from keel. Keel after Pr2 low or slightly pronounced, lacking definite spines.

Pr3: Lateral profiles sharp to moderate, lacking or with only very gradual scoop. Keel after Pr3 usually low or recessed on large crayfish, moderately pronounced on small specimens.

Pr4: Lateral profile sharp to moderate with scoops slight or absent; anterior margin very angular to angular; posterior margin convex to straight, sometimes irregular.

Processes 3 and 4 very narrow on specimens >40 OCL, broader on small crayfish.

**Setation:** Light.

**Punctuation:** Moderate to dense.

**Gastric mill:** TAP count 5.5-9.5 (TAP counts partly correlate with increasing specimen size); TAA count 1.0 (rarely 0.5 or 1.5); spread 4.5-8.5 (largely determined by the TAP count). Zygocardiac ear shorter on small crayfish. Urocardiac ridges 8-12 (increasing with size).

**Coloration:** Body very dark red or green, often almost black dorsally, slightly paler ventrolaterally. Thoracic spines tipped with red or orange, often orange patches on lateral cephalon. General tubercles red or orange. Rostral spines red. L and D-L abdominal spines red, D spines often deep purple. Carpus and propodus of cheliped similar in colour to cephalothorax, propodus often crimson with green mottling laterally. Chela spines usually red. Finger tips orange or red.

Body red and orange ventrally, tinged in places with green. Carpus of cheliped very dark green mesally, red or orange laterally. Propodus bright red with mesal edge dark red/green and dark mottling basally. Fingers red.

**Sexes:** Males possess a cuticle partition, and mature at 20-40 OCL (spermatophores present).

Females develop open gonopores at 40-60 OCL; all >60 OCL are mature.

**Distribution and biology.** The known range of *E. suttoni* extends from the Stanthorpe area in southern Queensland, 120 km south along the Great Divide to Dundee near Glen Innes, and along the eastern spur of the Gibraltar Range. The species inhabits tributaries of the Severn and Dumaresque Rivers (Darling River system), draining to the west, and tributaries of the Clarence River to the east, occurring in streams and cold

water swamps in predominantly granite country at elevations above 680 m a.s.l. (usually above 1000 m). Much of the range has been cleared for pasture but the natural vegetation of open sclerophyll and heath persists in places, especially along creeks and in national parks and state forests. *Euastacus suttoni* appears tolerant of clearing and grazing practices. Very small juveniles (<10 mm OCL) were found in April, indicating hatching only a few months earlier, possibly December or January. *Cherax* sp. was frequently collected downstream of *E. suttoni*.

**Remarks.** *Euastacus suttoni* is a rather invariable species, attributable in part to the fairly constant habitat across its range, without major geographical barriers. Southern specimens have slightly larger cervical and abdominal spines. Specimens from Gibraltar Range display slightly spinier telsons and uropods than northern populations, have a larger spine lateral to the dactylar base dorsally, generally lack a dorsal apical propodal spine and often possess more elongate chelae. Northern specimens (e.g., from the type locality near Stanthorpe and Bald Rock) have low TAP counts of 5.5-6.0 and spreads of 4.5-5.0. The teeth are closer and the ear longer in the south; dissected specimens from Bluff and Deepwater Rivers south of Tenterfield have TAP counts of 5.5-7.0 and spreads of 4.5-6.0. In the south-east of the species' range (Gibraltar Range), TAP counts are 7.5-9.0 and spreads are 6.5-8.5. This variation represents a distinct cline in tooth counts.

The cephalothoracic background colour of northern specimens is less distinctly deep red/black, being more a deep olive green, than southern crayfish.

### *Euastacus valentulus* Riek

Figures 17, 18

*Potamobius serratus*—White, 1850: 96 (in part, Richmond R. as locality?).

*Euastacus valentulus* Riek, 1951: 380.—Riek, 1956: 1.—Riek, 1969: 896, figs 16E, 20A-D, H-J.

**Material examined.** Allotype: Qld, upper reaches of Currumbin Creek, southeast Queensland, 1 Oct 1953, E.F. Riek, AM P13038, ♀, OCL 49.4 mm.

Other specimens: Qld. Upper reaches of Currumbin Ck, 1 Oct 1953, E.F. Riek, AM P13037, 7♂, 3♀; Upper Currumbin Ck, (28°14'S, 153°22'E), 5 May 1981, G.J. Morgan and S.J. Harders, QM W10975, 1♂ and a chela.

NSW. Teven Ck, 2 miles from Teven near Ballina, 28 Sep 1954, A. Racek, AM P15521, 1♀; Stream below Victoria Park, inland from Ballina, 8 Oct 1962, JCY, AM P14623, 1♂, 1♀; Minyan Falls near Rosebank, Lismore area, 11 Jan 1958, E.F. Riek, AM P15730, 2♂, 1♀; Wil-

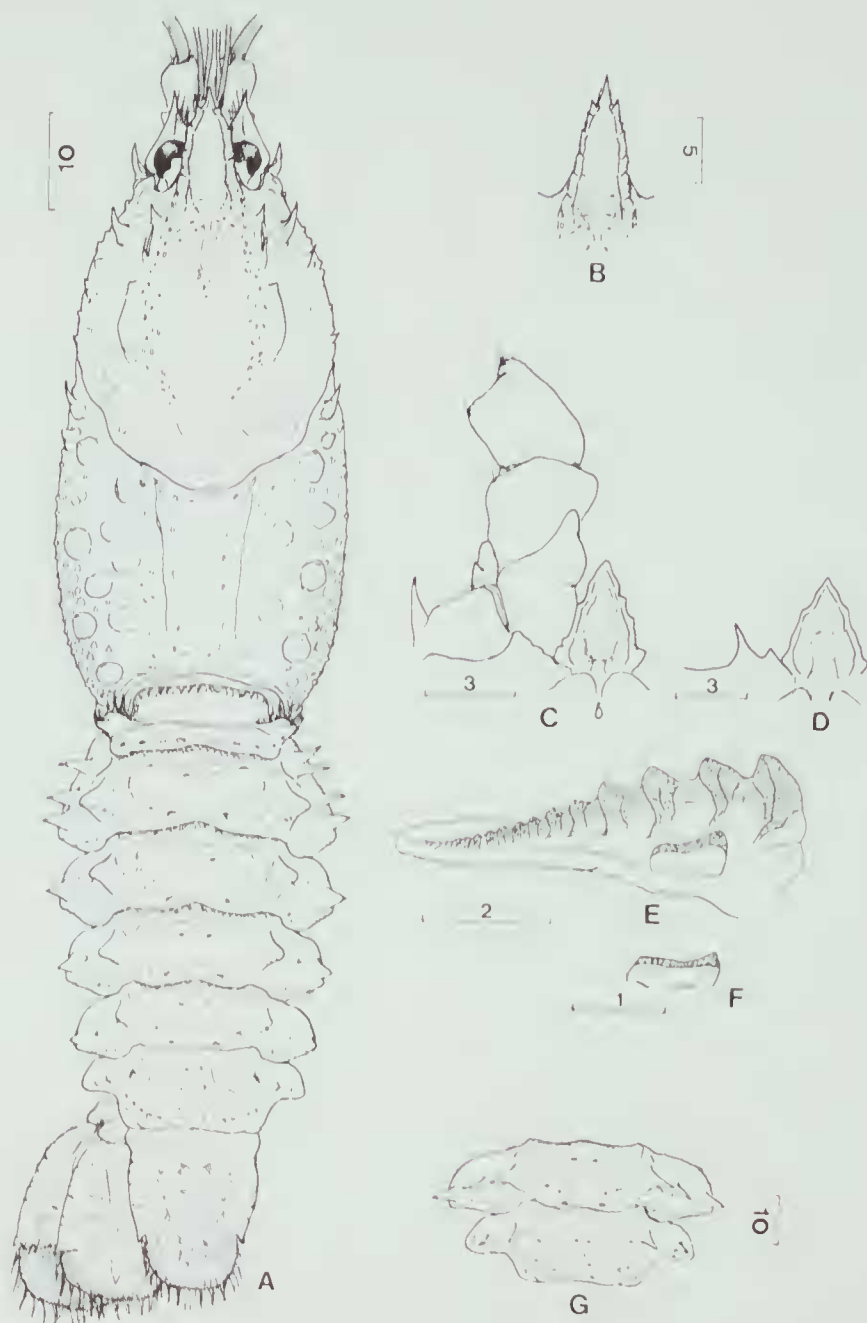


Figure 17. *Enastacus valentulus*. A, dorsal view (allotype ♀, Currumbin Ck, AM P13038); B, rostrum: more numerous spines, more elongate (allometry) (♀, Minivan Falls, AM P15730); C, ventral cephalon (allotype ♀); D, interantennal and hind coxopodite spines (♀, Currumbin Ck, AM P33912); E, zygocardiac ossicle (allotype ♀, Francois collection); F, zygocardiac ear: slightly longer (♂, Brunswick R., AM P33918); G, abdominal somites 5 and 6: larger spines (allometry) (♀, Wilsons Ck)



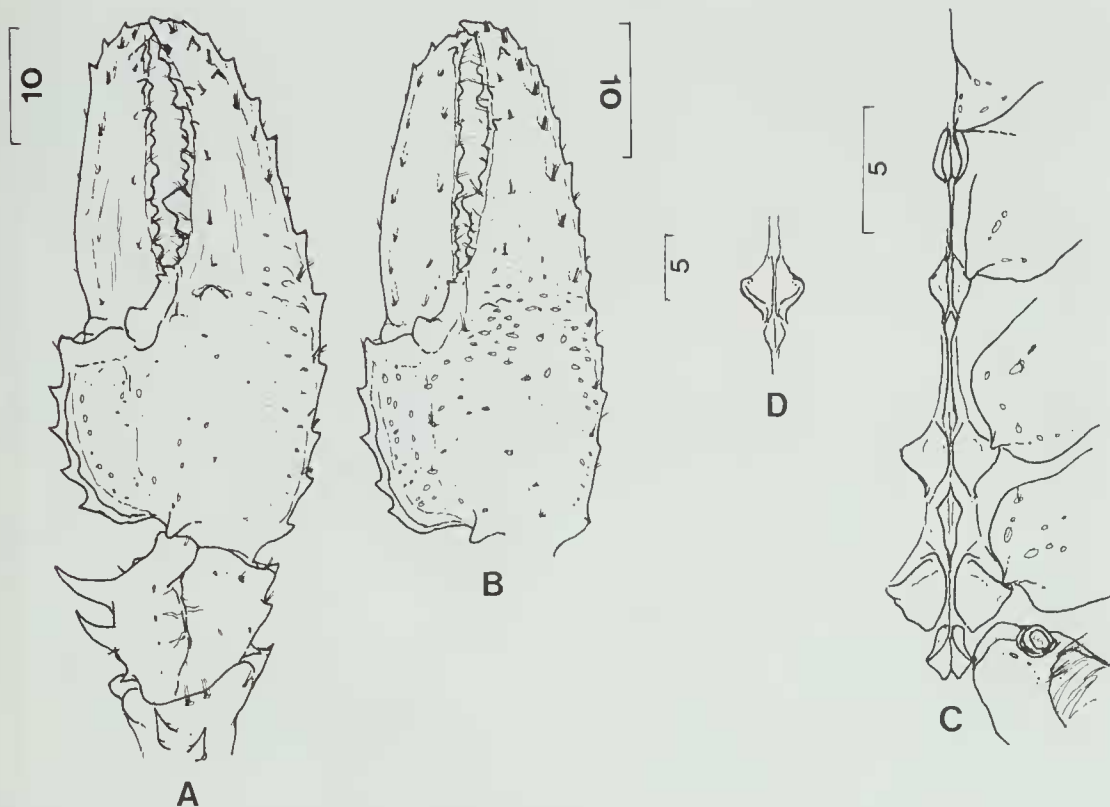


Figure 18. *Euastacus valentulus*. A, dorsal view chela (allotype ♀); B, chela: more elongate, 1 apical propodal spine, fewer spines above dactylar cutting edge, spine lateral to dactylar base very small (all largely allometry) (♂, Minyon Falls, AM P15730); C, sternal keel (♂, Brunswick R.); D, keel Pr2: broad, very open (♀, Wilsons Ck).

sons Ck, south of Mullumbimby, Sep 1980, R. Wilesmith, 1♂, 1♀; Wilsons Ck, south of Mullumbimby, (28°38'S, 153°28'E), 2-4 Sep 1981, G.J. Morgan and S.J. Harders, 2♂; Doon Doon Ck, 28 Jun 1979, 2♂; Mt Warning, 26 Mar 1967, QM W2861, 1♀; Korrumbyn Ck, foot of Mt Warning, (28°24'S, 153°19'E), 25 Mar 1981, G.J. Morgan and S.J. Harders, AM P33912, 1♂, 1♀; Back Ck, Unungar State Forest, (28°26'S, 152°43'E), 29-30 Mar 1981, G.J. Morgan and S.J. Harders, AM P33914, 1♂, 4♀; Boomi Ck, Edinburgh State Forest, (28°27'S, 152°39'E), 30 Mar 1981, G.J. Morgan and S.J. Harders, AM P33911, 1♀; Couchy Ck, north of Chillingham, (28°17'S, 153°16'E), 4 May 1981, G.J. Morgan and S.J. Harders, AM P33909, 1♂, 1♀; Upper Brunswick R., near Nullum State Forest, (28°29'S, 153°24'E), 2 Sep 1981, G.J. Morgan and S.J. Harders, AM P33918, 1♂, 1♀; Rocky Ck, Whian Whian State Forest, (28°36'S, 153°21'E), 5 Sep 1981, G.J. Morgan and S.J. Harders, AM P33917, 1♀; Tributary Rocky Ck, Whian Whian S.F., (28°34'S, 153°20'E), 5 Sep 1981, G.J. Morgan and S.J. Harders, AM P33910, 1♂.

**Diagnosis.** Male cuticle partition present. Rostral marginal spine row reaching proximal to midlength

of carinae. Rostral base divergent, carinae of medium length to long. Antennal squame widest at slightly or distinctly proximal to midlength. Squamal spines absent. Suborbital spine large or very large. Thoracic spines large (>40 OCL). General tubercles large or medium-sized, moderate to sparse in density. 2-4 large Li spines on abdominal somite 2. D Abdominal spine usually absent. Abdominal boss poorly developed. Usually 2-5 small or tiny telsonic surface spines, sometimes absent. Uropod lacking spines. Lateral propodal spines in 2 to 1 row condition. 1-3 dorsal apical propodal spines. Spines above propodal and dactylar cutting edges usually apical. Usually 5 mesal propodal spines. Dorsal and marginal mesal dactylar basal spines absent. 3-4 apical mesal dactylar spines. Dorsolongitudinal groove of carpus deep. 2 (rarely 3) mesal carpal spines. Ventromesal carpal spines much smaller than ventral spine. Keel Pr1 semi-abrupt to sloped, and apart. TAP count 2.5-3.5.

*Description.* Maximum OCL: 91.1 mm.

*Rostrum:* Rostrum broad, reaching beyond base, sometimes beyond midlength, of 3rd antennal segment; some specimens <40 OCL with rostrum reaching to end or distal to end of segment. Rostral sides parallel or slightly convergent; base slightly to distinctly divergent, carinae of medium length to long. Marginal spines numbering 3-6 per side, in row reaching proximal to midlength or almost full length of carinae; spines medium-sized to large, usually moderately pointed to sharp (one very large specimen with rounded spines, probably due to abrasion). Acumen spine slightly to much larger than marginal spines on specimens >40 OCL, very much larger on most smaller specimens.

OCL/CL 0.72-0.85 i. RW/OCL 0.16-0.23 d.

*Cephalon:* Cephalon moderately spiny to very spiny on specimens >20 OCL, some very small crayfish poorly spinose; usually 1 or 2 large spines and smaller bumps ventral to postorbital ridges. 1st postorbital spine medium-sized to large, very large on some specimens <20 OCL. 2nd postorbital spine a small edge on specimens >40 OCL, medium or large on some smaller specimens. Suborbital spine large or very large and obviously curved inwards. 1 lateral margin of antennal squame convex to slightly concave; squame widest slightly proximal to midlength on largest specimen, distinctly proximal on most specimens and very proximal on some small crayfish; marginal spines absent. Interantennal spine broad, very broad on some specimens <20 OCL; margin scalloped or toothed. Antennal basipodite spine small to medium-sized on specimens >40 OCL, large or very large on most smaller specimens; coxopodite spine small to medium-sized on specimens >60 OCL, small to large on lesser specimens and usually weakly bifid or slightly serrated. ScL/OCL 0.15-0.33 d.

*Thorax:* Approximately 5-13 thoracic spines per side except on some very small specimens lacking spines. Spines large on specimens >40 OCL, medium-sized to small on lesser crayfish; sharp to blunt spines on most specimens (dorsal spines often broad and flat); spines blunter on smaller animals and usually rounded or flat when present on specimens <20 OCL. Spines arranged in zone or approximately 2 rows. General tubercles large to medium-sized on specimens >20 OCL, small or very small on specimens <20 OCL, absent on smallest individuals; tubercle density moderate to sparse on specimens >20 OCL, sparse to very sparse on smaller animals. 1-2 (rarely 3) cervical spines, dorsalmost usually large or very large and sharp, 2nd medium or small.

ArL/OCL 0.36-0.41; ArW/OCL 0.15-0.21 d; CaW/OCL 0.56-0.68 i; CaD/OCL 0.50-0.57 d.

*Abdomen:* D-I spine on somite 1 of specimens >40 OCL and most specimens 20-40 OCL, absent on smaller crayfish; spine very large or large on specimens >60 OCL, usually medium-sized or small on lesser animals, and very sharp on specimens >60 OCL, sharp or moderately pointed on smaller crayfish. D spine absent on somite 1 (largest specimen with bumps in D position). On somite 2, 3-4 I i spines per side on specimens >40 OCL, 2 (rarely 1)-4 on smaller specimens, 0 spines on specimens <20 OCL. Li spine on somites 3-5 of specimens >20 OCL,

absent on smaller crayfish. Li spines decreasing in size posteriorly, very large to large or medium-sized on specimens >60 OCL, large to medium or small on specimens 40-60 OCL and medium to small or tiny on smaller animals; spines very sharp to moderate on specimens >40 OCL, sharp to blunt on specimens 20-40 OCL. Lii spines absent on somites 2 and 3, sometimes present on somites 4 and 5, and 1 or 2 Lii spines present on somite 6 of specimens >20 OCL; Lii spines large to medium-sized and very sharp on largest specimen, medium-sized to tiny and moderately pointed to blunt on others. D-I spine on somite 2 of most specimens >20 OCL (absent on smaller specimens in 20-40 OCL range); spine present on subsequent somites of specimens >40 OCL and many smaller specimens (one specimen with 2 small D-I spines on somite 6). D-L spines very large to small and very sharp on specimens >60 OCL, large to tiny and sharp to blunt on crayfish 40-60 OCL, medium-sized to tiny and moderate to very blunt on smaller specimens. D spine usually absent, but some specimens of all sizes with small to tiny and very blunt spine on some somites. Low dorsal abdominal boss on some specimens >60 OCL, vague or absent on smaller animals.

AhdW/OCL  $\sigma$  0.49-0.56 i,  $\varnothing$  0.52-0.64 i; OCL/L 0.34-0.41 i.

*Tailfan:* Usually 2-5 very small or tiny telsonic surface spines on specimens >20 OCL, though largest specimen lacking spines. Marginal spines on telson and uropods absent, outer margins of uropods merely bumpy. Standard spines medium-sized to large.

TeL OCL 0.34-0.41 d.

*Chelae:* Chelae elongate to stout. Teeth well developed on specimens >60 OCL.

*Propodus:* Lateral propodal spines in 2 to 1 row condition, ventral row often poorly developed on specimens of all sizes; some regenerate chelae and specimens <20 OCL with only dorsal propodal row. Lateral spines small or medium-sized and sharp on specimens >60 OCL, large on some smaller specimens. 1 lateral spine ridge vague or absent. Usually 5 mesal propodal spines; some regenerate chelae and some specimens <40 OCL with 4 or 6 spines. 3 dorsal apical spines on specimens >60 OCL, 1-3 on most specimens 20-60 OCL; some chelae (especially regenerate and on specimens <20 OCL) lacking apical spines. 2-3 spines above cutting edge of propodus on specimens >60 OCL, usually 1-3 on specimens 20-40 OCL, some specimens slightly >20 OCL and all <20 OCL lacking spines; spines usually apical, rarely in row reaching to midlength of gape; spines usually large and moderately pointed or sharp, small on most specimens <40 OCL. Usually 1 or 2 small, blunt spines lateral to dactylar base dorsally, though spines sometimes absent and two small specimens with 3 and 5 small spines. Very poor development of bumps on lateral ridge. Ventrally, usually 1 or 2 small or medium (rarely large) spines lateral to dactylar base (one specimen with 5 spines on one chela). Spines absent proximal to dactylar articulation, very low ridge sometimes present. Precarpal spines absent.

PropL/OCL  $\sigma$  0.86-0.99,  $\varnothing$  (0.82)0.89-0.97; PropW/PropL 0.35-0.48 id; PropD PropL 0.22-0.30 id.

Dactylus: 2-3 spines above dactylar cutting edge of specimens >40 OCL, 1-3 (sometimes 0) on specimens 20-40 OCL, 0 spines on some regenerate chelae and specimens <20 OCL; spines apical and very large to medium-sized on specimens >40 OCL, small on many specimens <40 OCL. Extra dorsal dactylar spines absent. Dorsal and marginal mesal dactylar basal spines absent. 3-4 apical mesal dactylar spines (one medium-sized specimen with 2 apical spines and bump on one dactylus); some specimens <20 OCL with 2 spines on one chela, one specimen with regenerate chela with 5 apical spines. Dactylar groove absent on specimens >60 OCL, vague or shallow on smaller animals.

DactL/PropL 0.49-0.60.

Carpus: Dorsolongitudinal groove deep. Usually 2 mesal carpal spines, sometimes bump or small spine proximal to 2nd; one small specimen with 3 distinct spines on one carpus and 2( + 1) on other. Distalmost spine much larger than, and distinctly offset ventrally to, 2nd. 2 lateral carpal spines (1 spine on one specimen); lateral spines usually medium-sized, sometimes large or small. Articulation spine absent except on some <40 OCL with small or medium spine. Dorsal carpal spines usually absent though some specimens <40 OCL with small spine or low bump. Ventral carpal spine very large or large. 1-2 ventromesal spines, largest medium-small to tiny (much smaller than ventral spine).

Merus: Usually 6-8 dorsal meral spines. Outer meral spine usually large, occasionally medium-sized.

Keel: Pr1: Posterior margins semi-abrupt to sloped; ventral profiles flat, rounded or slightly angled down or back; processes apart or very apart and either closed or parallel in orientation. Keel after Pr1 usually slightly pronounced anteriorly, sometimes anterior spine present.

Pr2: Open or very open. Keel after Pr2 slightly or distinctly pronounced.

Pr3: Usually slight or gradual scoops and moderate to rounded bases; occasional specimens lacking scoops. Keel after Pr3 moderately pronounced on large specimens, distinctly pronounced on smaller animals.

Pr4: Scoops developed on largest specimen, but usually only slight or absent; bases rounded to moderate, sharper on some specimens <40 OCL, and posterior margins straight, irregular or slightly convex; anterior edges angular or very angular (ridged).

Processes 3 and 4 broad, very broad on small specimens.

Setation: Light.

Punctuation: Moderately dense on large animals, dense on small specimens.

Gastric mill: TAP count 2.5-3.0 (rarely 3.5); TAA count 1.0-1.5; spread 1.0-2.0. Teeth large and rather spaced; zygocardiac ear relatively short. Urocardiac ridges 5-8.

Coloration: Body dark green, green/brown or green/blue (occasionally red/brown) dorsally, paler ventrolaterally. Thoracic spines dark green or black. General tubercles pale brown. Posterior margins of abdominal somites darker than anterior. L abdominal spines often yellow or orange with black tips; D-L and D spines dark. Carpus and propodus of cheliped blue/green. Propodal

lateral spines white, mesal spines orange. Dactylus blue or blue/green. Fingertips pale yellow.

Body red, green, orange and yellow ventrally, sometimes with white and blue patches. Carpus of cheliped blue or blue/green, sometimes yellow laterally; ventral spine sometimes orange. Propodus blue with dark mesal edge, an orange patch near articulation with dactylus. Dactylus blue.

Small crayfish green or brown, with patches of yellow.

Sexes: Males possess a cuticle partition. One female in the 40-60 OCL range is berried and another has gonopores that appear to be opening. The one female in the 60-80 OCL range has closed gonopores, but those of the specimen >80 OCL are open and it is likely that most females mature in the 40-80 OCL range.

*Distribution and biology.* The species ranges from upper Currumbin Ck west of the Gold Coast, southeast Queensland, south to the Ballina area of New South Wales, a distance of approximately 90 km, and from coastal northern NSW west to the Woodenbong area, approximately 100 km. *Euastacus valentulus* is present in the Tweed, Richmond and upper Clarence systems, as well as in some smaller coastal streams where the terrain is hilly and the species ranges into mountain forest to elevations of 600 m. Natural vegetation in its range is largely coastal rainforest and wet sclerophyll forest but most has been cleared for agriculture. *Euastacus valentulus* is not confined to forested areas but prefers streams retaining some natural growth along the banks. Females bear eggs in winter which usually hatch in October-November.

*Euastacus valentulus* and *E. sulcatus* cohabit many streams, the former at lower altitudes. A species of *Cherax* is occasionally sympatric with *E. valentulus* but usually occurs farther downstream.

*Remarks.* The species does not show marked clinal character variation over its range and specimens from southeast Queensland are very similar to those from the Lismore-Ballina area of New South Wales. Most specimens examined were in the 20-40 OCL range and only limited numbers of larger animals are present in collections.

The holotype of *E. valentulus* was lodged in the Queensland Museum but appears to be lost (fide Riek, 1969: 896) and could not be found for this study.

### *Euastacus setosus* (Riek)

Figures 19, 20

*Euastacoides setosus* Riek, 1956: 4-5. — Riek, 1969: 897. — Riek, 1972: 374, fig. 12.

*Material examined.* Holotype: Qld, Mt Glorious, 4 Nov 1953, E.F. Riek, AM P12887, ♂, OCL 27.4 mm.



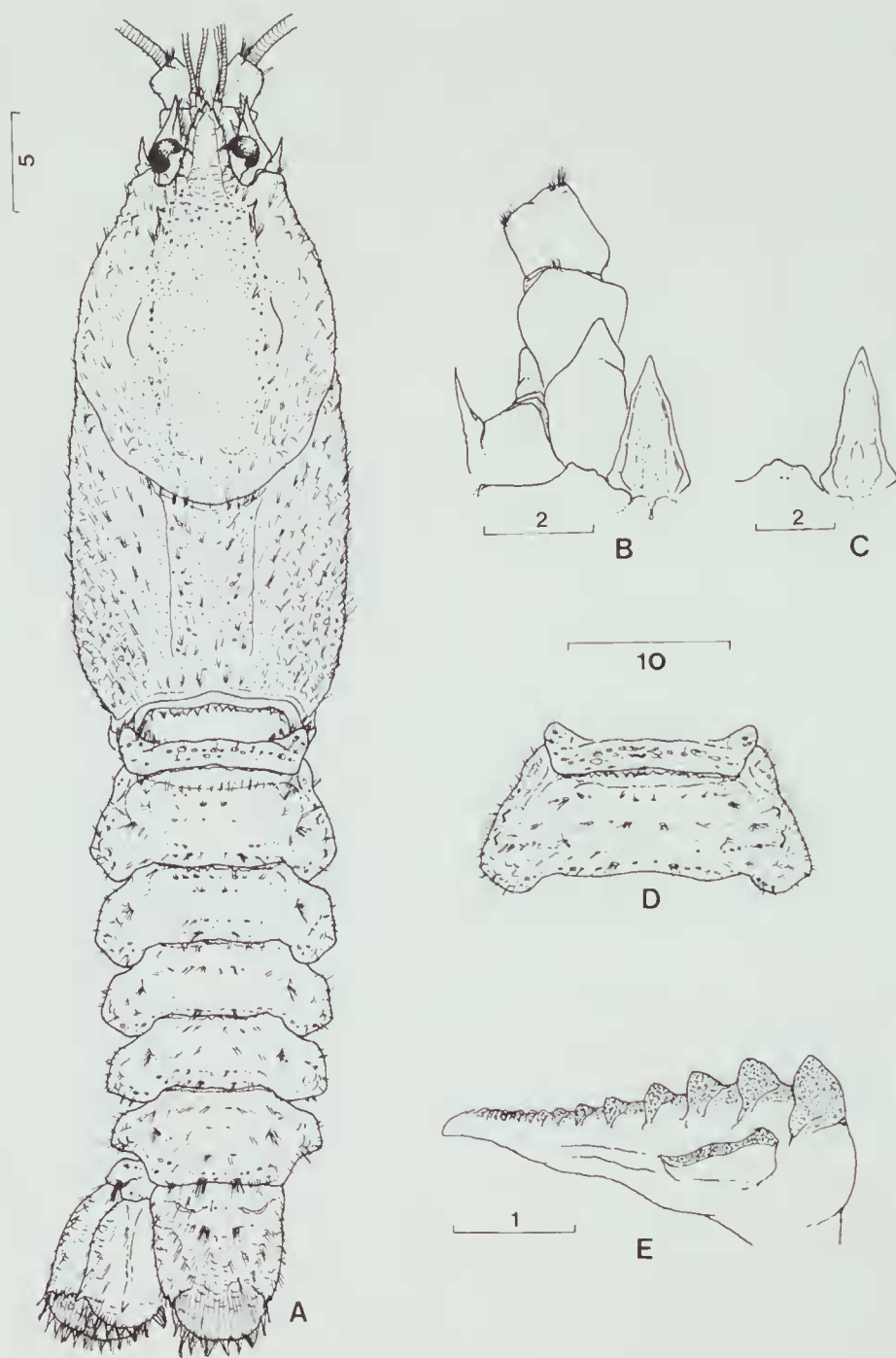


Figure 19. *Euastacus setosus*. A, dorsal view (holotype ♂, Mt Glorious, AM P12887); B, ventral view cephalon (holotype ♂); C, elongate interantennal spine (♂, Maiala Nat. Park, QM W10960); D, abdominal somites 1 and 2: Li spines slightly better developed, abdomen broader (sexual) (♀, Maiala Nat. Park, QM W10960); E, zygocardiac ossicle (holotype ♂, Francois collection).



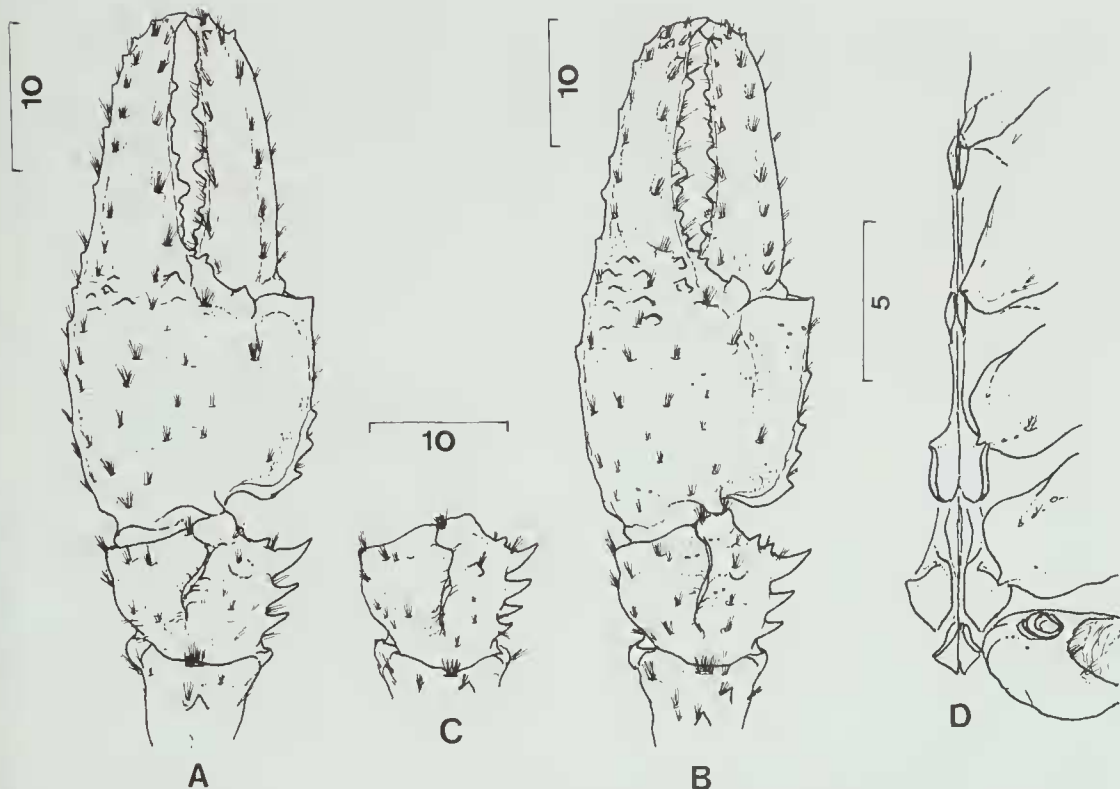


Figure 20. *Euastacus setosus*. A, dorsal view chela (holotype ♂); B, chela: dorsal apical propodal spine present, 5 mesal propodal spines, 2 small distal mesal carpal spines (♂, Maiala Nat. Park); C, carpus: 4 large mesal spines (+1 distal) (allotype ♀, Mt Glorious, AM P12887); D, sternal keel (holotype ♂).

Allotype: Type locality, AM P12887, ♀, OCL 31.8mm.

Paratypes: Qld, type locality AM P12823, 23 specimens.

Other specimens: Qld, Mt Glorious near Greens Falls, Maiala National Park, 12 Apr 1972, QM W5082, 1♂; Mt Glorious, 18 Jul 1943, E.F. Riek(?), AMP11928, 1♀; Tributary Cedar Ck, Maiala N.P. near Mt Glorious, (27°20'S, 152°46'E), 5 Oct 1982, G.J. Morgan and S.J. Harders, QM W10960, 5♂, 4♀.

**Diagnosis.** Male cuticle partition present. Rostral marginal spine row reaching proximal to midlength or full length of carinae. Rostral base divergent or very divergent, carinae short and spread. Antennal squame widest very proximal to midlength. Squamal spines absent. Suborbital spine large or very large. Thoracic spines absent. General tubercles small or very small, and rather dense to sparse. Li abdominal spines reduced to small bumps. D spines and abdominal boss absent. Tailfan spines absent. Ventral lateral propodal spine row absent. Dorsal apical propodal spines usually absent (rarely 1). Usually 1 apical spine above propodal and dactylar cutting edges. Usually 4 mesal propodal

spines. Dorsal and marginal mesal dactylar basal spines absent. 2 apical mesal dactylar spines. Dorsolongitudinal groove of carpus deep. Usually 4-5 mesal carpal spines. Largest ventromesal carpal spine larger than ventral spine. Keel Pr1 abrupt or semi-abrupt, and close. TAP count 3.5 (rarely 3.0).

**Description.** Maximum OCL: 38.5 mm.

**Rostrum:** Rostrum very short, reaching base of 3rd antennal segment only on some specimens <20 OCL. Rostral sides convergent or slightly convergent, almost parallel on some very small specimens. Rostral base divergent or very divergent, carinae short and spread. 3 (rarely 2)-5 rostral spines per side, in row reaching proximal to midlength or full length of carinae; spines medium-sized or small, moderately pointed to sharp. Acumen spine similar in size to marginals.

OCL/CL 0.84-0.88 i; RW/OCL 0.13-0.18 d.

**Cephalon:** Cephalon spiny to moderately spiny on specimens >20 OCL, poorly spinose on smaller animals, with several small spines (usually 1 slightly larger) ventral to postorbital ridges. 1st postorbital spine small to medium-sized; 2nd postorbital spine absent. Suborbital spine large or very large. Lateral margin of squame usually

slightly concave, sometimes approximately straight; squame widest very proximal to midlength, slightly proximal on some very small specimens; marginal spines absent. Interantennal spine elongate to medium in width on specimens >20 OCL, medium to broad on smaller crayfish; margins straight or slightly serrated. Antennal basipodite spine absent; coxopodite spine small or tiny and unimodal, weakly bifid, or slightly serrated.

ScL/OCL 0.14-0.21 d.

**Thorax:** Dorsal thoracic spines absent. General tubercles small or very small, absent on some specimens <20 OCL (merely punctate); tubercles rather dense to sparse, very sparse or absent on some animals <20 OCL. 2-4 cervical spines on specimens >20 OCL; spines small (rarely medium-sized) or tiny and blunt (rarely moderate) to very blunt, vague or absent on specimens <20 OCL.

ArL/OCL 0.37-0.41; CaW/OCL 0.50-0.55 i; ArW/OCL 0.15-0.19 d; CaD/OCL 0.44-0.49 d.

**Abdomen:** Somite 1 lacking D and D-L spines. Somite 2 with 2-3 small or tiny, blunt or very blunt Li spines on specimens >30 OCL, 1-2 spines on some specimens 20-30 OCL; spines often merely bumps. A tiny, very blunt Li spine sometimes on somites 3 and 4 of large specimens. 1-3 tiny, very blunt Lii spines (little more than setal bumps) on somites 3-6 of some large specimens. D and D-L spines absent. Specimens <20 OCL lacking abdominal spines. Dorsal abdominal boss absent.

AhdW/OCL  $\sigma$  0.44-0.49,  $\varphi$  0.45-0.56 i; OCL/l 0.38-0.43 i.

**Tailfan:** Tailfan spines absent, though setal bumps usually obvious on margins of uropods. Standard spines small or medium/small on specimens >20 OCL, medium-sized on smaller animals.

TeL/OCL  $\sigma$  0.32-0.38 d,  $\varphi$  0.33-0.39 di.

**Chelae:** Chelae intermediate in shape to elongate, lateral propodal margin often slightly concave. Teeth well developed on most specimens >30 OCL.

**Propodus:** 1 lateral propodal spine row (ventral row absent); lateral spines small and rather sharp. Lateral spine ridge vague or absent. Usually 4 mesal propodal spines, sometimes 3 or 5 especially on regenerate chelae (one specimen with 6 spines on regenerate chela); usually distinct gap between distal and 2nd mesal spines. Dorsal apical propodal spines absent, except one large specimen with 1 spine on one chela. Usually 1 spine above propodal cutting edge of specimens >30 OCL and on many smaller animals (one specimen with 2 spines on its larger chela); spines apical and medium-sized or small; spines usually absent on specimens <20 OCL. Dorsally 1-6 usually small spines lateral to dactylar base, with some small lateral bumps; ventrally 1-8 small spines, often in row extending along finger; specimens <20 OCL often lacking dorsal and ventral spines. Spines proximal to dactylar articulation absent; precarpal spines absent.

PropL/OCL  $\sigma$  0.88-1.08 i,  $\varphi$  0.87-1.01 i; PropW/PropL 0.39-0.45; PropD/PropL 0.28-0.34.

**Dactylus:** 1 apical spine above dactylar cutting edge (some regenerate chelae with 0 or 2 spines), some very small specimens lacking spine; spine medium-sized to small. Extra dorsal dactylar spines absent. Mesal dactylar

basal spines absent. Usually 2 apical mesal dactylar spines, 1 on some very small animals. Dactylar groove present though shallow on specimens >30 OCL.

DactL/PropL 0.49-0.55.

**Carpus:** Dorsolongitudinal groove deep. Usually 4-5 mesal carpal spines, distalmost spine sometimes very small and always smaller than 2nd; relative sizes of 3rd to 5th spines variable. Usually small or tiny lateral carpal spine, sometimes absent. Articulation spine small or absent; dorsal carpal spine usually present. Ventral carpal spine small to medium-sized. 3-7 ventromesal spines, largest medium-sized to large and longer than ventral spine.

**Merus:** 8-12 small dorsal meral spines. Outer meral spine small or tiny.

**Keel:** Pr1: Posterior margins usually abrupt or semi-abrupt; processes angled back, close and parallel. Keel after Pr1 low and lacking spines.

Pr2: Close or slightly apart and usually parallel (rarely slightly closed). Keel after Pr2 low or very slightly pronounced.

Pr3: Usually parallel (sometimes slightly closed), posterior edges moderate to sharp, lacking scoops. Keel after Pr3 raised, very raised on small specimens, usually most pronounced centrally.

Pr4: Moderately rounded to sharp, scoops absent; anterior edges angular or very angular, posterior edges convex, irregular, or approximately straight.

Processes 3 and 4 usually distinctly narrow, almost broad on some specimens <20 OCL.

**Setation:** Heavy.

**Punctuation:** Dense or very dense.

**Gastric mill:** TAP count 3.5 (rarely 3.0); TAA count 1.0 (rarely 1.5); spread 2.0-2.5. Urocardiac ridges 4-7 (usually 5-6). Urocardiac ossicle shallow.

**Coloration:** Body dark red/brown dorsally, paler ventrolaterally. Cephalic and cervical spines pale yellow. Often blue/violet tinge on lateral margins of abdominal somites. Carpus and propodus of cheliped with dark green mottling on orange or brown, mesal spines dark green. Fingers dark green/brown, sometimes with a blue tinge, tips pale brown.

Body orange and cream ventrally. Carpus of cheliped dark green or green/blue mesally, orange and cream laterally, ventral spines orange. Propodus cream or pale orange with darker orange or green mottling, mesal edge green. Fingers pale orange or blue/green.

**Sexes:** Males possess a rather wide cuticle partition. One female 20-30 OCL and three of the four females in the 30-40 OCL range have gonopores that appear to be opening or are very deeply incised. The largest female (OCL 38.5 mm, collected recently) is berried. It appears that females mature at close to 40 OCL.

**Distribution and biology.** The species has been collected from tributaries of the Pine River at altitudes above 500 m a.s.l. in rainforest in Maijala National Park near Mt Glorious, northwest of Brisbane, Queensland. Rainforest elsewhere in the area has been extensively cleared though it persists in some gullies of national parks and state forests. Higher ridges support sclerophyll forests. The berried

female was collected in early October. Eggs are maroon. A species of *Cherax* occurs widely at lower altitudes.

**Remarks.** While *E. setosus* probably occurs elsewhere in the D'Aguilar Range, only the type locality has yielded specimens.

### *Euastacus urospinosus* (Riek)

Figures 21, 22

*Euastacoides urospinosus* Riek, 1956: 5-6. — Riek, 1969: 898.

**Material examined.** Holotype: Qld, Obi Obi Ck, Maleny, 8 Oct 1953, E.F. Riek, AM P12886, ♂, OCL 13.9 mm.

Other specimens: Qld, Tributary of Obi Obi Ck, above falls, Mapleton Falls National Park, (26°38'S, 152°52'E), 7 Oct 1982, G.J. Morgan and S.J. Harders, QM W10959, 5♂, 2♀.

**Diagnosis.** As for *E. setosus*, except: Rostral marginal spine row not reaching proximal to midlength of carinae. Suborbital spine small, rarely medium-sized. 1-3 small blunt thoracic spines posterior to cervical spines (>30 OCL). General tubercles sparse. 2-3 small Li spines on abdominal somite 2, sometimes merely bumps. Spines above propodal cutting edge absent. 5 (rarely 6) mesal propodal spines. 1 apical mesal dactylar spine. 4 mesal carpal spines. TAP count 2.5-3.0.

**Description.** Maximum OCL: 36.7 mm (none collected in 20-30 OCL range).

**Rostrum:** Rostrum very short, not reaching base of 3rd antennal segment, just distal to base on smallest specimen (holotype). Rostral sides slightly convergent or parallel; rostral base divergent and carinae spread. Usually 1-2 marginal spines per side; spines small, moderately pointed to rounded, apical or to midlength of carinae. Usually 1-3 low carinal bumps posterior to spines. Acumen spine similar to marginal spines.

OCL/CL 0.83-0.90 i; RW/OCL 0.12-0.17 d.

**Cephalon:** Spination moderate on large specimens, poor on specimens <20 OCL, with several small spaced spines (sometimes 1 distinctly larger) ventral to postorbital ridges. 1st postorbital spine small, medium-sized on smallest animal (holotype). 2nd postorbital spine absent or on one side only; when present, spine an edge or small. Suborbital spine small or medium-small, medium-sized on some specimens <20 OCL. Lateral margin of antennal squame straight or slightly irregular; squame widest very proximal to midlength, at approximately midlength on smallest specimen; marginal spines absent. Interantennal spine elongate on specimens >30 OCL, rather broad on specimens <20 OCL; margin slightly serrated. Antennal basipodite spine very small or small, occasionally absent; coxopodite spine very small or small, usually very weakly bifid.

ScL/OCL 0.13-0.18 d.

**Thorax:** On specimens >30 OCL, 1-3 small, blunt or moderately sharp dorsal spines immediately dorsal and posterior to cervical spines; animals <20 OCL lacking dorsal spines. General tubercles small or very small, sparse or very sparse. 2-5 cervical spines per side, small or very small and moderately pointed on specimens >30 OCL, blunt on animals <20 OCL.

ArL/OCL 0.38-0.42 i; CaW/OCL 0.54-0.56; ArW/OCL 0.12-0.18 d; CaD/OCL 0.45-0.52 d.

**Abdomen:** Somite 1 lacking D and D-L spines. On somite 2, 2-3 small or tiny, moderately pointed or blunt Li spines on most specimens >30 OCL (sometimes merely bumps); spines absent on specimens <20 OCL. Subsequent somites lacking Li spines. Lii, D-L and D spines absent, sometimes setal bumps in Lii position. Dorsal abdominal boss absent.

AbdW/OCL 0.45-0.50; OCL/L 0.39-0.44 i.

**Tailfan:** Tailfan spines absent, setal bumps obvious on margins of uropods. Standard spines small on specimens >30 OCL, medium-sized on specimens <20 OCL.

TeL/OCL 0.30-0.37 d.

**Chelae:** Chelae intermediate in shape or elongate. Teeth well developed on specimens >30 OCL.

**Propodus:** 1 lateral propodal spine row (ventral row absent); lateral spines small and rather sharp. Lateral ridge absent. Usually 5 (rarely 6) mesal propodal spines, 4 on some regenerate chelae. Dorsal apical spines absent. Spines above cutting edge absent (one regenerate chela with single spine). Dorsally, 1 or 2 medium-sized or small spines lateral to dactylar base, with few small bumps; ventrally, 1 small or medium-sized spine, sometimes with several tiny bumps distributed slightly along finger. Spines proximal to dactylar base absent. Precarpal spines absent.

PropL/OCL (0.81)0.83-0.98 i; PropW/PropL 0.44-0.49; PropD/PropL 0.28-0.30.

**Dactylus:** 1 apical, medium-sized spine above dactylar cutting edge of specimens >30 OCL (one regenerate chela with 2 spines); specimens <20 OCL lacking spines. Extra dactylar dorsal spines absent. Mesal dactylar basal spines absent. Usually 1 apical mesal dactylar spine (some regenerate chelae lacking or with 2 spines). Dactylar groove shallow or distinct.

DactL/PropL 0.56-0.58.

**Carpus:** Dorsolongitudinal groove deep. 4 mesal carpal spines; distalmost spine smaller than 2nd, 4th often very small on specimens <20 OCL. 2 small lateral carpal spines, 1 on some specimens <20 OCL. Articulation spine present on some specimens <20 OCL. 1-2 small dorsal carpal spines, except on smallest specimen (holotype). Ventral carpal spine medium/large to small. Usually 3-4 ventromesal spines, largest medium-sized to large and larger than ventral spine.

**Merus:** 7-10 small dorsal meral spines. Outer spine small or tiny.

**Keel:** Pr1: Posterior margins semi-abrupt or abrupt, profiles usually angled back, rarely flat; processes close (rarely slightly apart) and parallel. Keel after Pr1 occasionally with small sharp spine.



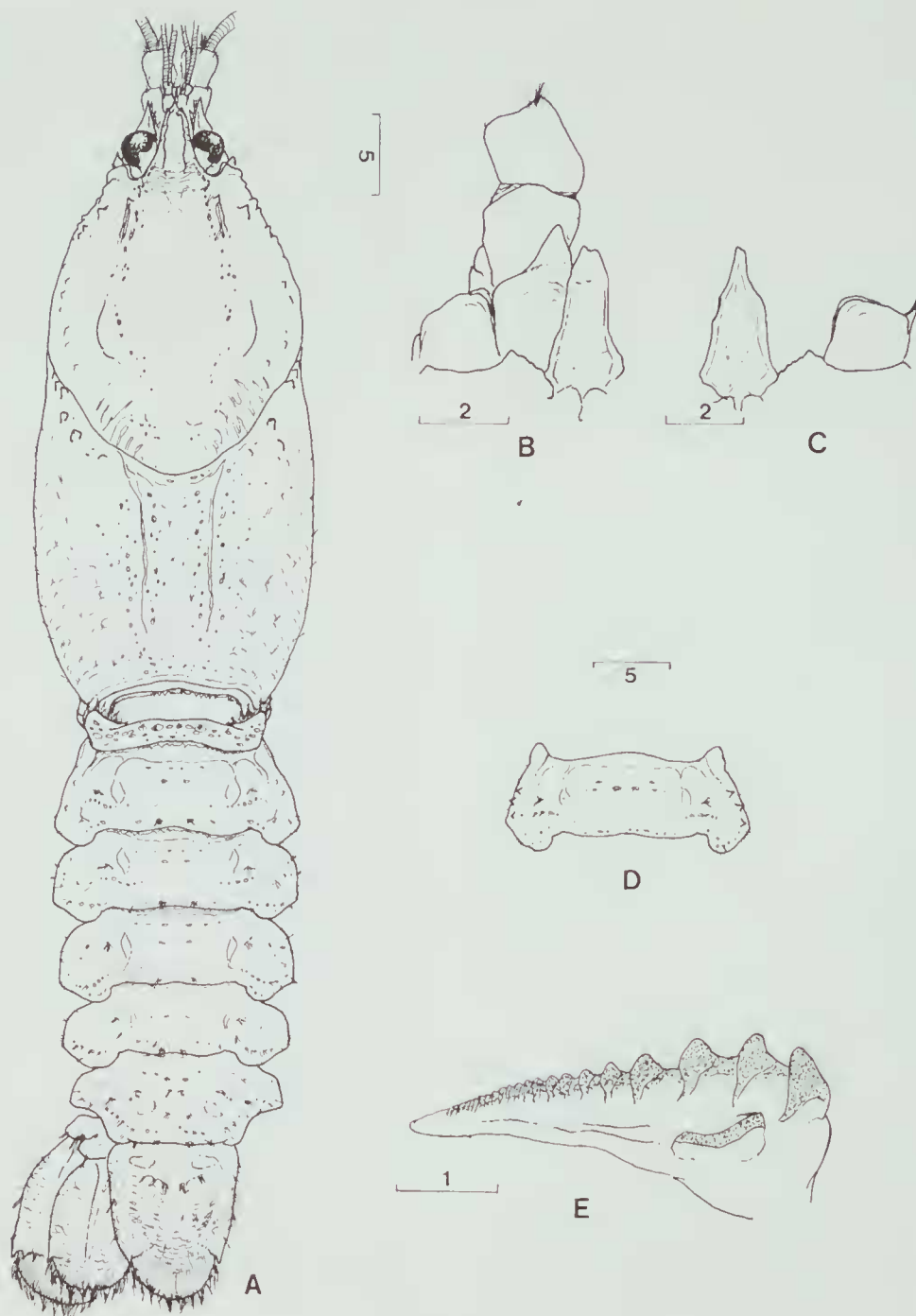


Figure 21. *Euastacus urospinosus*. (All specimens from Mapleton Falls, QM W10959). A, dorsal view ( $\sigma$ ); B, ventral view cephalon (suborbital spine deformed) ( $\sigma$ ); C, ventral view cephalon ( $\sigma$ ); D, abdominal somite 2: Li spines distinct ( $\varnothing$ ); E, zygocardiac ossicle ( $\sigma$ ).



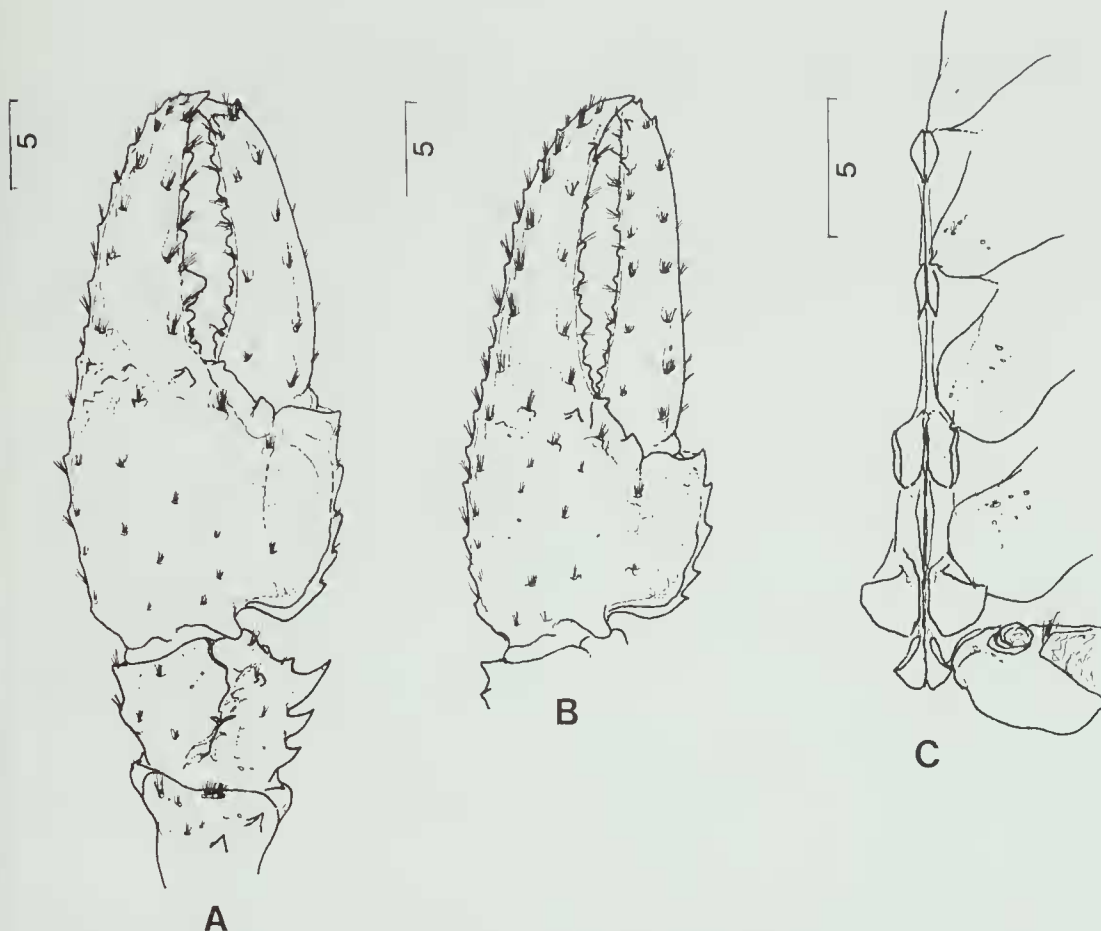


Figure 22. *Euastacus urospinosus*. (All from males, QM W10959). A, dorsal chela; B, chela: elongate, 2 apical dactylar spines, spine present above propodal cutting edge, (regenerate); C, sternal keel.

Pr2: Parallel and close on large specimens, apart on some animals <20 OCL. Keel after Pr2 usually saddle-shaped, sometimes with small spine.

Pr3: Usually approximately parallel, lateral profile sharp or moderate, scoops absent or very gradual. Keel after Pr3 distinctly raised, usually posteriorly pronounced.

Pr4: Scoops absent, laterally moderately curved or sharp; anterior edges angular, posterior slightly or distinctly convex.

Processes 3 and 4 narrow on specimens >30 OCL, broad on some animals <20 OCL.

**Setation:** Moderate to light.

**Punctuation:** Sparse or moderate on cephalon, denser on thorax.

**Gastric mill:** TAP count 2.5-3.0; TAA count 1.0-1.5; spread 1.0-2.0. Urocardiac ridges 5-6. Urocardiac ossicle rather shallow.

**Coloration:** Body red-brown with green tinges dorsally, paler ventrolaterally. Blue tinges on lateral cephalon. Cervical and cephalic spines pale orange or yellow. Abdominal somites blue/violet laterally. Abdominal Li spines pale

yellow. Carpus of cheliped orange with dark green/brown mottling, distolateral edge bright orange, mesal spines dark green. Propodus ochre with green mottling, edges green or blue/green. Fingers green with blue tinges, tips paler yellow.

Body pale orange, yellow and cream ventrally. Carpus of cheliped dark green or blue/green mesally, orange laterally, ventral spine orange. Propodus mostly cream with blue mottling, mesal area orange with green mottling. Fingers blue and cream.

**Sexes:** Males possess a cuticle partition. No mature females have been collected and only one female >30 mm OCL is known.

**Distribution and biology.** The species is known only from tributaries of Obi Obi Creek (Mary River) between Maleny and Mapleton, west of Nambour, in rainforest at altitudes above 240m. Little highland rainforest remains uncleared in the area, though pockets persist in national parks and state forests. Vegetation at the type locality has been cleared for

pasture as it was in 1953 when the juvenile holotype was collected (Riek, 1956). This specimen was probably washed downstream from upstream rainforest. Species of *Cherax* and *Macrobrachium* are common in streams with cleared banks and at lower altitudes.

**Remarks.** This small species has been sampled from essentially a single site. *Euastacus urospinosus* was described by Riek (1956) on the basis of one very small specimen (OCL 13.9 mm) which does not display the characteristics of larger animals.

### *Euastacus madae* (Riek)

#### Figure 23

*Euastacoides madae* Riek, 1956: 5. — Riek, 1969: 898.

**Material examined.** Holotype: Qld, upper reaches of Currumbin Ck, 1 Dec 1953, E.F. Riek, AM P12888, ♂, OCL 24.8 mm.

Allotype: Type locality, AM P12888 ♀, OCL 21.9 mm.

**Diagnosis.** As for *E. setosus*, except: Antennal squame widest at midlength. Suborbital spine small. 4-6 small Li spines on abdominal somite 2. 1-2 dorsal apical propodal spines. Spines above propodal cutting edge absent. 3-4 mesal propodal spines. 1-2 apical mesal dactylar spines. 4 mesal carpal spines.

**Description.** 2 specimens, OCL 24.8 mm, 21.9 mm.

**Rostrum:** Rostrum very short, not reaching or just reaching base of 3rd antennal segment. Rostral sides slightly convergent or almost parallel. Base divergent or very divergent, carinae spread. 3-4 marginal spines distributed along full length of carinae; spines medium-sized, moderately pointed or rounded. Acumen spine similar to marginal spines.

OCL/CL 0.87-0.88; RW/OCL 0.14-0.15.

**Cephalon:** Cephalon moderately spiny or spiny with 2-3 small spines and several small bumps ventral to postorbital ridges. 1st postorbital spine small; 2nd spine small on one specimen, absent on other. Suborbital spine small. Lateral margin of squame straight; squame widest at midlength; marginal spines absent. Interantennal spine medium width, margin slightly serrated. Antennal basipodite spine absent or very small; coxopodite spine small and bifid.

ScL/OCL 0.15.

**Thorax:** Dorsal thoracic spines absent. General tubercles small or very small and moderately dense. Approximately 4 cervical spines per side, small or tiny and blunt.

ArL/OCL 0.36-0.37; CaW/OCL 0.49-0.50; ArW/OCL 0.16; CaD/OCL 0.44-0.45.

**Abdomen:** Somite 1 lacking D and D-L spines. Somite 2 with 4-6 small or tiny, moderately pointed to blunt Li spines. Lii, D-L and D spines absent. Dorsal abdominal boss absent.

AbdW/OCL 0.46-0.48; OCL/L 0.40-0.41.

**Tailfan:** Tailfan spines absent, marginal setal bumps on uropods. Standard spines small.

Tel/OCL 0.34-0.35.

**Chelae:** Chelae elongate, with lateral propodal margins slightly concave. Teeth moderately developed on both specimens (indicating further growth to maximum size).

**Propodus:** Single lateral propodal spine row (ventral row absent). Lateral spines small and rather sharp. Lateral spine ridge absent. 3-4 mesal propodal spines, with distinct gap between 1st (distal) and 2nd. 1-2 dorsal apical spines. Spines above cutting edge absent. 1-2 small or medium-sized spines lateral to dactylar base dorsally, with few slight bumps; ventrally, 1 small or medium-sized spine. Spines proximal to dactylar articulation absent. Precarpal spines absent.

PropL/OCL ♂ 1.02, ♀ 0.94; PropW/PropL 0.40-0.42; PropD/PropL 0.27-0.28.

**Dactylus:** 1 large or medium-sized apical spine above dactylar cutting edge. Extra dorsal dactylar spines absent. Mesal dactylar basal spines absent. 1-2 apical mesal dactylar spines. Dactylar groove shallow.

DactL/PropL 0.53-0.54.

**Carpus:** Dorsolongitudinal groove deep. 4 mesal carpal spines. Distalmost spine considerably larger than others, which decrease in size proximally. 1 small lateral carpal spine. Articulation and dorsal carpal spines absent. Ventral carpal spine very small or tiny. 2-4 ventromesal spines, with largest large or moderately large and much larger than ventral spine.

**Merus:** 5-8 small dorsal meral spines. Outer meral spine tiny.

**Keel:** Pr1: Posterior margins semi-abrupt, ventral edges angled down; processes close and parallel. Keel after Pr1 low, sometimes slight anterior bump.

Pr2: Open and slightly apart. Keel after Pr2 low, recessed anteriorly.

Pr3: Lateral profile moderately sharp, with rounded bases and gradual scoops. Keel after Pr3 not prominently raised.

Pr4: Lateral profile moderately sharp, scoops absent; anterior edges angular, posterior edges straight or slightly concave.

Pr3 and 4 narrow.

**Setation:** Moderate to moderately heavy.

**Punctuation:** Dense.

**Gastric mill:** TAP count 3.5; TAA count 1.0-1.5; spread 2.0-2.5. Urocardiac ridges 4-5. Urocardiac ossicle shallow.

**Coloration:** No live specimens of *E. madae* were collected during this study. Riek (1956) described *E. madae* as "rather nondescript with some bluish tinge on abdomen and great chelae".

**Sexes:** The male bears a cuticle partition. The small female (allotype) has unopen gonopores.

**Distribution and biology.** The species is known only from rainforest at the upper reaches of Currumbin Creek, west of Coolangatta, south-east Queensland. Riek (1956) noted that it was collected "in association with *E. sulcatus* and a second species of *Euastacus* of which only juveniles were seen."

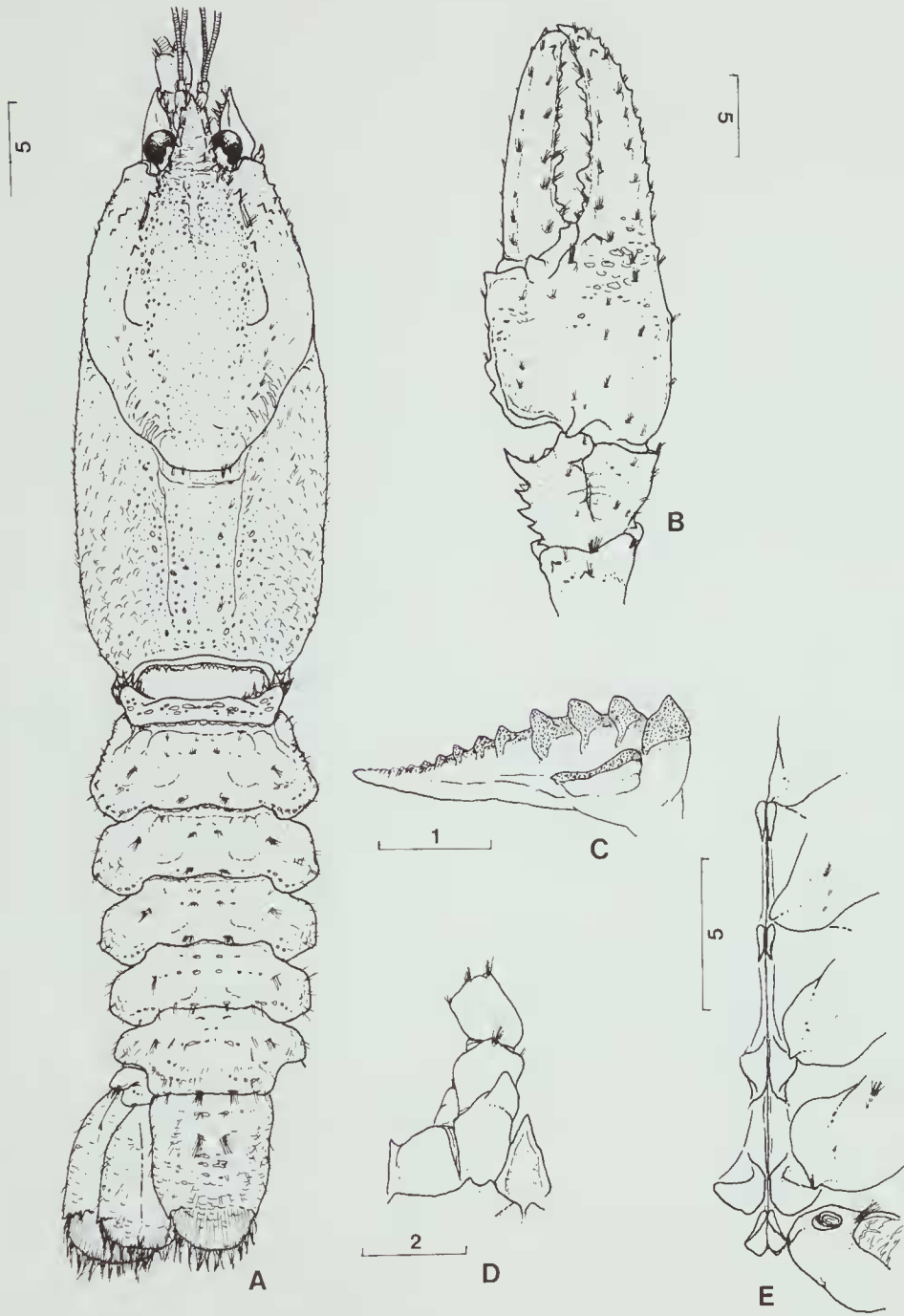


Figure 23. *Euastacus madae*. A, dorsal view (holotype ♂, Currumbin Ck, AM P12888); B, dorsal view chela (holotype ♂); C, zygocardiac ossicle (holotype ♂, Francois collection); D, ventral view cephalon (allotype ♀, AM P12888); E, sternal keel (holotype ♂).

**Remarks.** *Euastacus madae* is known from only two specimens from the type locality, both specimens falling in the arbitrary size class of 20-30 OCL. Riek (1969: 898) recorded additional specimens from the type locality in the AM but these could not be located for this study and there is no record of them on the museum registry.

***Euastacus jagara* sp. nov.**

Figures 24, 25

**Material examined.** Holotype: Qld, Flaggy Ck, 3000 ft, Mistake Mts via Laidley, 11 Feb 1973, S. and G. Montiech, QM W6471, ♂, OCL approx. 47.1 mm.

Paratypes: Qld, type locality, QM W6471, 1♂, 4♀.

**Diagnosis.** As for *E. setosus*, except: Rostral spines apical or in row reaching midlength of carinae. Antennal squame widest proximal to midlength. Suborbital spine small. General tubercles sparse. Spines above propodal cutting edge absent. 6-7 mesal propodal spines. 1 apical mesal dactylar spine. 3-6 mesal carpal spines. Keel Pr1 sloped or almost semi-abrupt. TAP count 4.0.

**Description.** Maximum OCL: 47.1 mm (approximate, carapace broken).

**Rostrum:** Rostrum very short, not reaching base of 3rd antennal segment (except on one specimen <20 OCL). Rostral sides slightly convergent or almost parallel. Rostral bases divergent or very divergent, carinae spread. 1-2 marginal spines per side, apical or distributed to midlength of carinae; spines small or medium/small and moderately sharp. Acumen spine similar to marginals.

OCL/CL 0.87-0.89; RW/OCL 0.12-0.17 d.

**Cephalon:** Cephalic spination poor or moderately poor, with 1-2 small spines and several bumps below postorbital ridges. 1st postorbital spine small edge on largest specimen, small on specimens <30 OCL. 2nd postorbital spine small edge on largest animal, edge on specimens <30 OCL. Suborbital spine very small or small. Lateral margin of squame slightly convex, concave or straight; squame widest proximal to midlength; marginal spines absent. Interantennal spine elongate on specimens >20 OCL, medium width on smaller animals; margins slightly or distinctly serrated. Antennal basipodite spine very small or absent; coxopodite spine medium-sized to small, usually weakly bifid.

ScL/OCL 0.13-0.19 d.

**Thorax:** Dorsal thoracic spines absent (largest specimen, holotype, with much of branchiostegites missing, but no evidence of spines). General tubercles small or very small, sparse or very sparse; specimens <20 OCL lacking tubercles. 2-5 cervical spines per side, small and moderately pointed to blunt.

ArL/OCL 0.38-0.44 i; CaW/OCL 0.51-0.54; ArW/OCL 0.16-0.18 (largest missing); CaD/OCL 0.46-0.49 d.

**Abdomen:** Somite 1 lacking D-L and D spines. Largest specimen (holotype) with 2-3 small, very blunt Li

spines on somite 2 (little more than bumps); other specimens lacking spines. Low Li and Lii bumps on somites 3 and 4 of holotype. D-L and D spines and dorsal boss absent.

AbdW/OCL 0.46-0.48; OCL/L 0.41-0.46 i.

**Tailfan:** Tailfan spines absent; marginal setal bumps on uropods. Standard spines very small on largest specimen, small to medium-sized on smaller animals.

Tel/OCL 0.29-0.36 d.

**Chelae:** Chelae elongate. Teeth well developed on specimens near or >30 OCL.

**Propodus:** 1 lateral propodal spine row (ventral row absent); lateral spines small and rather sharp. Lateral spine ridge vague or absent. 6-7 mesal spines on normal chelae of specimens >20 OCL, 4-5 on smaller animals. Dorsal apical propodal spines and spines above cutting edge absent. Spines usually absent lateral to dactylar base dorsally and ventrally, low setal bumps often present. Spines absent proximal to dactylar base, very low bumps sometimes present. Precarpal spines absent.

PropL/OCL 0.81-0.97 i; PropW/PropL 0.38-0.44; PropD/PropL 0.28-0.32.

**Dactylus:** Largest specimen with 1 small apical spine above dactylar cutting edge; specimens <30 OCL lacking spines. Extra dorsal dactylar spines and mesal basal spines absent. 1 apical mesal spine (vague on smallest specimen). Dactylar groove present.

DactL/PropL 0.54-0.56.

**Carpus:** Dorsolongitudinal groove deep. 3-6 mesal carpal spines, 3 or 4 spines usually distinctly larger than others; distalmost spine often smaller than 2nd and sometimes absent; 3rd and 4th spines usually small. 1-2 small or very small lateral carpal spines. Articulation spine absent. Dorsal carpal spines absent (low bumps on largest specimen). Ventral spine medium-sized or medium/small on specimens >20 OCL, small or very small on lesser crayfish. Largest ventromesal spine medium/large or medium-sized on specimens >20 OCL, small or very small on lesser specimens, and larger than or similar size to ventral spine; other ventromesal spines tiny.

**Merus:** 7-10 very small dorsal meral spines. Outer spine absent or tiny on specimens >20 OCL, small on lesser crayfish.

**Keel:** Pr1: Posterior margins sloped or almost semi-abrupt; ventral profile angled down or slightly back; processes close and parallel. Keel after Pr1 lacking distinct spines, sometimes slight bump.

Pr2: Processes parallel, close or slightly apart on specimens >20 OCL, slightly or distinctly apart on smaller animals. Keel after Pr2 low, sometimes slightly pronounced anteriorly.

Pr3: Slight or gradual scoops, moderate or rounded. Keel after Pr3 low on largest specimen, moderately to distinctly pronounced on smaller crayfish.

Pr4: Posterior edge bases moderately curved without scoops (rarely slight scoops), slightly or distinctly convex; anterior edges rounded on largest specimen, rounded to angular on specimens 20-30 OCL, angular on smaller crayfish.

Processes 3 and 4 distinctly narrow on largest speci-



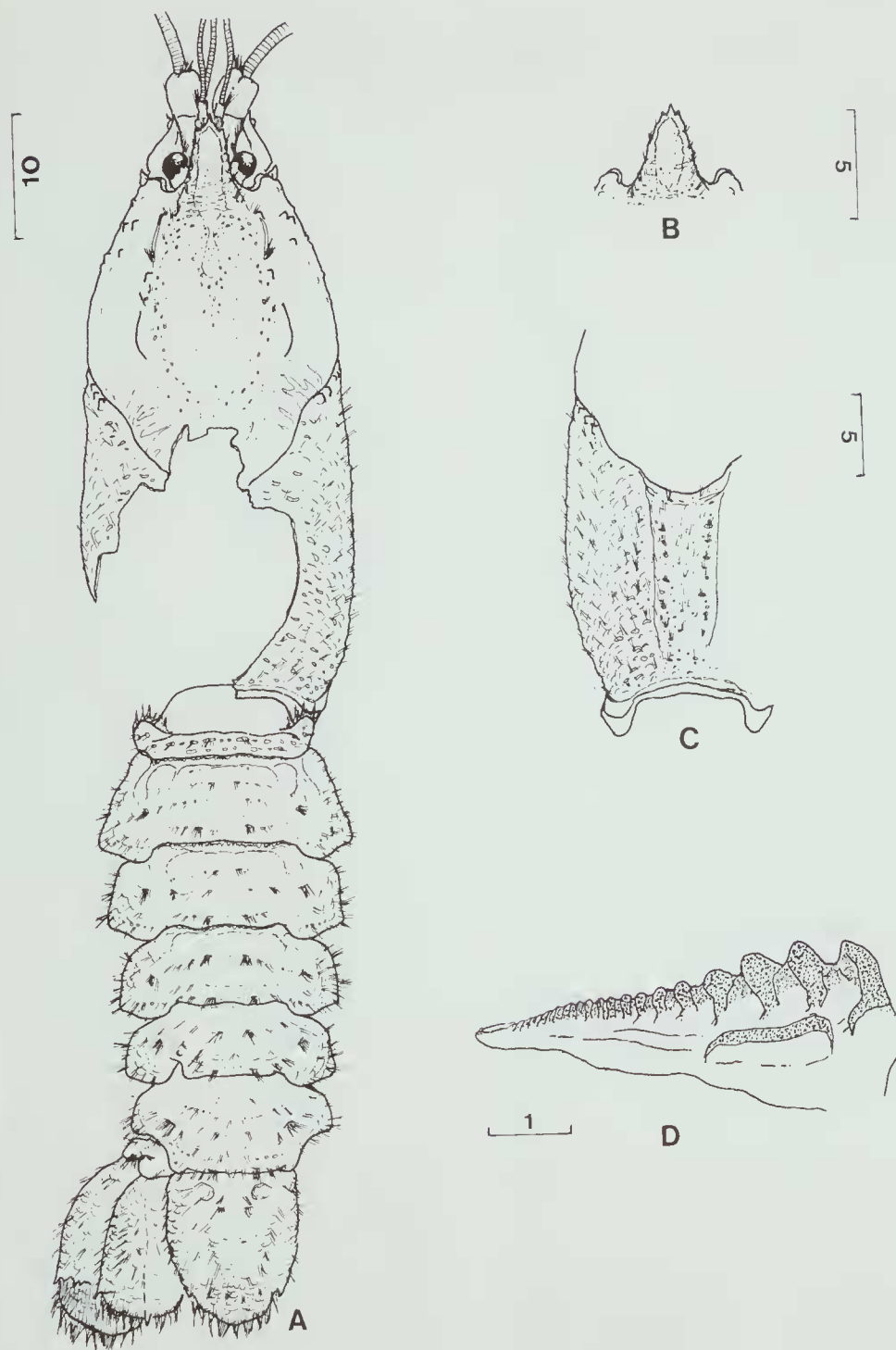


Figure 24. *Euastacus jagara*. A, dorsal view (holotype  $\sigma$ , Flaggy Ck, QM W6471); B, rostrum: broader (paratype  $\varphi$ , QM W6471); C, thorax: illustrating areola width and tubercles (paratype  $\varphi$ ); D, zygocardiac ossicle (holotype  $\sigma$ ).

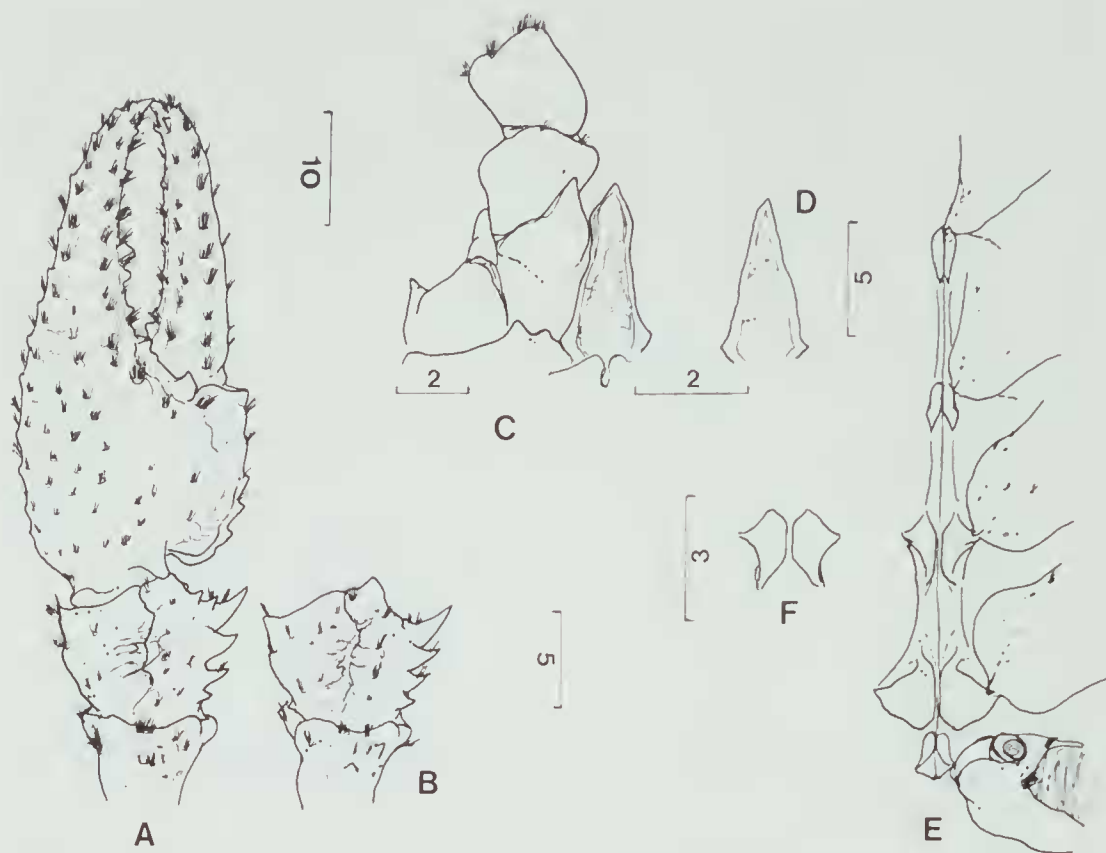


Figure 25. *Euastacus jagara*. A, dorsal view chela (holotype ♂); B, earpus: no distinct spines distal to mesal spines (paratype ♀); C, ventral view cephalon (holotype ♂); D, interantennal spine (paratype ♀); E, sternal keel (holotype ♂); F, keel Pr 3: broader (allometry) (paratype ♀).

men, just narrow on specimens 20-30 OCL, just broad on smaller crayfish.

*Setation*: Moderate to heavy.

*Punctuation*: Moderate on largest specimen, dense on smaller specimens.

*Gastric mill*: TAP count 4.0; TAA count 1.0-1.5; spread 2.5-3.0. Urocardiac ridges 5-7. Urocardiac ossicle shallow.

*Coloration*: No specimens of *E. jagara* were collected for this study and museum records bear no mention of colours of live crayfish.

*Sexes*: Males possess a wide cuticle partition. No mature females have been collected. Those in the 20-30 OCL range have closed gonopores, though pores of one specimen appear deeply incised.

*Distribution and biology*. The species is known only from the type locality at 920 m a.s.l. in the Mistake Mountains, approximately 50 km south-west of Ipswich. The range is drained by tributaries of the Brisbane River and supports rainforest along stream banks. *Cherax* and *Macrobrachium* were found at lower elevations. Further collection may

reveal a boundary between the ranges of *E. jagara* and *E. sulcatus* to the south, though the species may be sympatric in places.

*Etymology*. Named after Jagara, the probable aboriginal language of the Mistake Mts area (Capell, 1963).

#### General remarks

The four species, *E. setosus*, *E. urospinosus*, *E. maidae* and *E. jagara* form an identifiable group of species in south-east Queensland. The first three species were regarded by Riek (1956) as members of the genus *Euastacoides* and are similar in many respects with *E. jagara*. The genus is here synonymised with *Euastacus*. The four species may be regarded as members of a *setosus* species complex (species complex defined by Mayr, 1969), named for the best collected of the species. In separating *Euastacoides* from *Euastacus*, Riek (1956) cited two generic diagnostic characters (characters 1 and 3

below); in 1969 he added character 2 below. The name *Euastacoides* is retained in this discussion for convenience in comparisons with other *Euastacus*.

1. One lateral propodal spine row (i.e. the absence of a ventral row). This is valid for all four species of *Euastacoides* but does not distinguish the genus. Species of *Euastacus* show inter-(and often infra-) specific variation from 1 to 2 propodal rows, with most species displaying the 2 to 1 condition. Frequently the ventral propodal row is very poorly developed and most specimens of *E. reductus* Riek and many *E. neohirsutus* Riek from New South Wales have only 1 lateral spine row.

2. Carpus with irregular number of ventral spines (*Euastacus* should have only 1 enlarged spine).

There are usually several ventromesal (VM) spines on *Euastacoides* species and the largest is usually larger or much larger than the ventral (V) spine. In most species of *Euastacus* the V spine is larger or much larger than the largest VM spine but frequently there are several small VM spines. In some species (e.g., *E. reductus*, *E. neodiversus* Riek, *E. woiwuru* Morgan) however, the VM spine is similar to or larger than the V spine. The ventral surface of the carpus of *Euastacus reductus* and *Euastacoides* species can be very similar. The different populations of *Euastacoides* also display variation in the sizes and number of VM spines and the size of the V spine. The number of VM spines is usually lower on *E. maidae*. The *Euastacoides* condition is therefore uncommon but is exhibited by some *Euastacus*, especially the less spiny species.

3. *Euastacoides* lacks abdominal spines, having merely tufts of setae. The best collected population of *Euastacoides* is that from Mt Glorious (*E. setosus*). This species lacks sharp abdominal spines. However, some larger specimens have very obvious bumps on somite 2 in the position of the Li spines of *Euastacus* species. The question is whether to regard these bumps as blunt spines or to consider abdominal spines to be absent.

*Euastacoides urospinosus* from Obi Obi Ck in the high country west of Nambour, was described by Riek on the basis of one very small juvenile lacking abdominal spines, a character shared by similarly sized specimens of all species of *Euastacus*. Further sampling carried out for this study produced specimens of considerably greater size, including probably mature males and an almost mature female. While abdominal spination is uniformly poor, there are definitely small, moderately sharp or blunt Li spines on somite 2 of several large specimens. Those that lack distinct sharp spines possess bumps similar to those of *E. setosus*.

The two type specimens of *E. maidae* collected by Riek from upper Currumbin Ck remain the only known specimens of this species. Contrary to Riek's (1956) description, both crayfish possess small, moderately sharp or blunt Li spines on somite 2.

The population of *Euastacoides*-like crayfish from Flaggy Ck (*E. jagara*) is similar to *E. setosus* in possessing distinct abdominal bumps.

In summary, the absence of abdominal spines is not a constant feature of these crayfish. *Euastacus* displays extreme interspecific (and often infraspecific) variation in the size and number of abdominal spines. Some species (e.g. *E. reductus* and many specimens of *E. neohirsutus*) display very reduced abdominal spination, with small Li spines only on somite 2 and setal bumps on subsequent somites. This condition is similar to that of *E. maidae* and some *E. urospinosus*. It appears that the pleural bumps are vestigial spines and that in *E. setosus* extreme reduction of the characters is represented. Hence, an absence of abdominal spines does not distinguish *Euastacoides* from *Euastacus*.

In addition to the three generic diagnostic characters of Riek, there are several other morphological features worthy of discussion.

4. Squamal shape. The antennal squame of *E. setosus* and *E. urospinosus* is distinctly thinner and more elongate than that of other species of *Euastacus*. Riek (1956) described the squame of *E. urospinosus* as obviously broader than that of *E. setosus* and widest at approximately its midlength but this is not a valid specific difference. The squame of *E. urospinosus* is broadest at its midlength only on the very small juvenile holotype; larger specimens have a squame similar to that of *E. setosus*. The squame of *E. maidae* and *E. jagara* is rather broader and in the former species widest at approximately its midlength. The squame of *E. maidae* is similar to most *Euastacus* scales. If *E. maidae* is grouped with *E. setosus* and *E. urospinosus*, a thin squame is not a generically diagnostic character.

5. Overall reduction in spination. The reduction in abdominal spination has already been discussed in character 3. The species of *Euastacoides* also display reduced spination on the chelae and thorax. However, similarly poor spination is evident in some species of *Euastacus* (e.g. *E. reductus*, *E. simplex* Riek and *E. brachythorax* Riek). Larger specimens of *E. urospinosus* possess 1-3 very small, blunt thoracic spines behind the cervical spines, a condition common on poorly spined species of *Euastacus*.



6. Mesal carpal spination. The condition of the ventral carpal spines has been discussed above. The species *E. setosus* and *E. urospinosus* usually possess a small carpal spine distal to that corresponding to the first (distalmost) on most species of *Euastacus*, i.e. in contrast to most *Euastacus* the distalmost spine is usually not the largest. However, there is variation in carpal spination of these two *Euastacoides* species and some specimens lack the small first spine. In contrast to *E. setosus* and *E. urospinosus*, the two specimens of *E. maidae* display the usual *Euastacus* pattern with the first carpal spine largest. Specimens of *E. jagara* are somewhat intermediate: a small distal spine may be present but is usually absent or very weakly developed. Specimens of several species of *Euastacus* possess a small carpal spine or bump distal to the largest first spine, hence approaching the condition of *E. setosus* and *E. urospinosus*.

7. Sternal keel. The first keel processes (Pr1) are steeply angled back on *E. setosus* and *E. urospinosus*, an unusual condition for *Euastacus*. However, *E. maidae* and *E. jagara* have Pr1 angled down, a common *Euastacus* condition. Additionally, the 3rd processes (Pr3) are usually parallel in *E. setosus* and *E. urospinosus*, a rare condition in *Euastacus*, though usual for *E. simplex*. *Euastacoides maidae* and *E. jagara* display gradually scooped Pr3, similar to many *Euastacus*.

8. Gastric mill. The zygocardiac ossicles of *Euastacoides*-type crayfish have low tooth counts similar to those of many of species of *Euastacus*. The urocardiac ossicles are shallower than those of most *Euastacus* species but there is considerable variation in both *Euastacoides* and *Euastacus*, and *E. urospinosus* has ossicles deeper than those of *E. setosus*. *Euastacus reductus*, *E. neohirsutus* and *E. polysetosus* Riek possess shallow urocardiac ossicles similar to those of *Euastacoides*.

9. Inner ramus of uropod. The inner rami of the uropods are rather thin on the four *Euastacoides*-type species but variable in *Euastacus*. The rami of some *Euastacus* species (e.g., *E. simplex*) are similar to those of the *Euastacoides* types. The species *E. urospinosus* and *E. jagara* have the medial standard spine on the posterior edge of the uropod but in *E. maidae* the spine is slightly set in from the edge and in *E. setosus* distinctly so (usual for *Euastacus*).

In summary, there are no distinct and constant differences that warrant the separation of a genus *Euastacoides* from *Euastacus*. The three diagnostic characters described by Riek are invalid when sufficient specimens are examined. Additional

potentially diagnostic characters described above are similarly inconstant.

The species regarded by Riek as belonging to *Euastacoides* are similar to *Euastacus reductus* of New South Wales in external morphology and gastric mills. *Euastacus reductus* displays obvious abdominal spines (frequently only on somite 2) and varying development of the ventrolateral propodal spine row. Hence, *E. reductus* cannot be included in Riek's *Euastacoides*, yet provides an intermediate condition between that occurring in this group and in most species of *Euastacus*. The *Euastacoides* species are better regarded as a branch of the extremely variable genus *Euastacus*, corresponding in general form and habitat to the small non-spiny, high country *Euastacus* of New South Wales and Victoria.

*Euastacus fleckeri* and *E. robertsi* of far northern Queensland also comprise a recognizable species group. They differ from other species of *Euastacus* in their shallow dorsolongitudinal carpal groove, the complete lack of mesal dactylar spination, the development of a large mesoventral carpal spine offset from the ventromesal spines, and the unclear distinction between thoracic spines and general tubercles. These differences, particularly the first, are regarded here as significant and the two species may warrant generic differentiation from *Euastacus*.

Though geographically closest to *E. fleckeri* and *E. robertsi*, *E. balanensis* most closely resembles *E. eungella* of the Clarke Range 500 km to the south. The two species are similar to each other in general appearance but can be readily distinguished, especially by the spination of the chelipeds and coloration.

The four large, spiny species of southeast Queensland, *E. sulcatus*, *E. hystricosus*, *E. suttoni* and *E. valentulus* can be distinguished by patterns of spination of the thorax, abdomen and chelae. They differ from most of the large *Euastacus* species of the southern states in possessing a male cuticle partition.

The distribution of *Euastacus* in Queensland is consistent with that of relic populations. With the exception of *E. valentulus* in the far south, all species are restricted to relatively high mountain or plateau country. The genus is confined to higher altitudes as latitude decreases. It is likely that *Euastacus* extended over larger areas of Queensland during geological periods of higher rainfall and/or cooler climates (e.g., 8,000-10,000 years B.P.). The crayfish are usually restricted to cool fast-flowing mountain streams and this habitat will have constricted as climatic regimes became warmer and drier.



Most Queensland *Euastacus* species are confined to or display strict preference for streams in rain-forest or wet sclerophyll forest. The exception is *E. suttoni* inhabiting the open sclerophyll country of the New England plateau. The clearance of natural vegetation probably has restricted the ranges of most species.

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### References

- Capell, A., 1963. *Linguistic Survey of Australia*. Australian Institute of Aboriginal Studies: Canberra.
- Clark, E., 1936. The freshwater and land crayfishes of Australia. *Memoirs of the National Museum of Victoria* 10: 5-58.
- Clark, E., 1937. The life history of the Gippsland crayfish. *Australian Museum Magazine* 6:186-192.
- Clark, E., 1941. Revision of the genus *Euastacus* (crayfishes, family Parastacidae) with notes on the distribution of certain species. *Memoirs of the National Museum of Victoria* 12: 7-30.
- Clark, E. and Burnet, F.M., 1942. The application of serological methods to the study of the Crustacea. *Australian Journal of Experimental Biology and Medical Science* 20: 89-95.
- Dixon, R.M.W., 1972. *The Dyirbal Language of North Queensland*. Cambridge University Press: Cambridge.
- Flecker, H. and Flecker, P.O., 1936. The haunt of the north Queensland spiny crayfish. *North Queensland Naturalist* 4:18-20.
- Mayr, E., 1969. *Principles of Systematic Zoology*. McGraw-Hill: New York.
- McCulloch, A.R., 1917. Studies in Australian Crustacea. Part 4. *Records of the Australian Museum* 11: 231-238.
- Monroe, R., 1977. A new species of *Euastacus* (Decapoda: Parastacidae) from north Queensland. *Memoirs of the Queensland Museum* 18: 65-67.
- Morgan, G.J., 1986. Freshwater crayfish of the genus *Euastacus* Clark (Decapoda: Parastacidae) from Victoria. *Memoirs of the Museum of Victoria* 47: 1-57.
- Riek, E.F., 1951. The freshwater crayfish (family Parastacidae) of Queensland, with an appendix describing other Australian species. *Records of the Australian Museum* 22: 368-388.
- Riek, E.F., 1956. Additions to the Australian freshwater crayfish. *Records of the Australian Museum* 24: 1-6.
- Riek, E.F., 1969. The Australian freshwater crayfish (Crustacea: Decapoda: Parastacidae) with descriptions of new species. *Australian Journal of Zoology* 17: 855-918.
- Riek, E.F., 1972. The phylogeny of the Parastacidae (Crustacea: Astacoidea), and description of a new genus of Australian freshwater crayfishes. *Australian Journal of Zoology* 20: 369-389.
- Watson, K., 1935. A new *Astacopsis* from north Queensland. *Memoirs of the Queensland Museum* 10: 232-235.
- Watson, K., 1936. *Astacopsis fleckeri*. *Memoirs of the Queensland Museum* 11: 52.
- White, A., 1850. Descriptions of two species of Crustacea in the British Museum. *Proceedings of the Zoological Society of London* 18: 95-97.